Partial Shading Conditions of Solar Photovoltaic System

G.Esakkimuthu, Rajesh Krishnasamy, Ramkumar Aathi,

Abstract: Now a day's Renewable Energy like Solar Photo voltaic system play on important role on the Renewable Energy sector. Most of the Power losses dependent on the Partial shading conditions lot of Methods are available to predict the MPPT under partial shading conditions. In This paper gives the survey of the different MPPT strategy (or) Technique connected to solar photovoltaic (PV) system accessible until January, 2019. A various number of researchers report on various sorts of MPPT methods for a SPVA system together with usage. For as every methods are having some of advantages and disadvantages. Hence, a proper review of these method is very significant [31]. Various factors affecting the solar photo voltaic system performance such as solar irradiance, Temperature, soiling dust etc. Mainly the partial shading conditions are affecting the constant load Application due to sudden change of irradiance by cloud movement and also moving object near the solar Photo voltaic panel .So most of the researchers are concentrating on the partial shading conditions of the solar Photo voltaic system.

Keywords : Maximum power point tracking technique (MPPT), Partial shading conditions (PSC), Solar Photo Voltaic Array (SPVA).

I. INTRODUCTION

Recent Years the usage of the electronic and electrical devices (or) equipment's are increased Due to the growing of population as well as many peoples are wanted sophisticated life it means that increasing the electrical energy consumption devices like Air conditioner, Air cooler , fan etc.. it will lead to demand on electricity, then stock and increase the use of ordinary sources, (for example, coal and oil, Diesel Generator etc.), Sun based photovoltaic (PV) vitality turns into a promising elective source as it is ubiquitous, openly accessible, condition benevolent, and also it has the low maintenance and operational costs. Therefore, the need of Photo Voltaic power systems is by all accounts expanded day by day for both off grid and grid-Tied means on grid method of Photo Voltaic power

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generation. Therefore, an effective maximum power point tracking techniques are necessary to obtain the maximum output power at different natural conditions and afterward power the framework operating condition at that Maximum power point.

It is one of the type of controller part of the PV frameworks. Numerous sorts of MPPT procedures are as one with their execution are accounted for in the literature [31]. Customers are always feeling which type of MPPT controllers for a particular specified application. Tragically, just a couple of papers are accessible in this field incorporates dialogs on MPPT strategies until 2019. Therefor it is important to set up a survey that incorporates all the proficient and successful MPPT methods proposed before 2012 and after that until 2019. In this audit, an endeavor has additionally been made to think about the MPPT procedures based on their preferences, weaknesses and different parameters.

II. PV ARRAY UNDER PARTIALLY SHADED CONDITIONS

A Photo Voltaic module is constructed by series connected large number of Photo Voltaic cells. After that the Photo V oltaic modules can be again connected it may be series or parallel by the requirement of customer need it means that maximum voltage range with respect to type of application like water pumping [18]. Fig. (i) Demonstrates the current versus voltage (I–V) characteristic for the Photo Voltaic modules. The arrangement associated left side segment of the photograph voltaic modules is non shaded. Then series-connected right side portion of the photo voltaic module is lightly shaded. In the event that the arrangement associated Photo Voltaic modules are working at level of Ia, then the non-shaded portion of the photo voltaic module will work in the region forward bias condition , while the shaded portion of the photo voltaic module will be work in the reverse bias region. Subsequently, the shaded portion of the photo voltaic module will absorb electrical energy rather than providing it, and then it will be dissipated in terms of heat energy for all time harm the module it will lead to failure of photo voltaic cells [29].
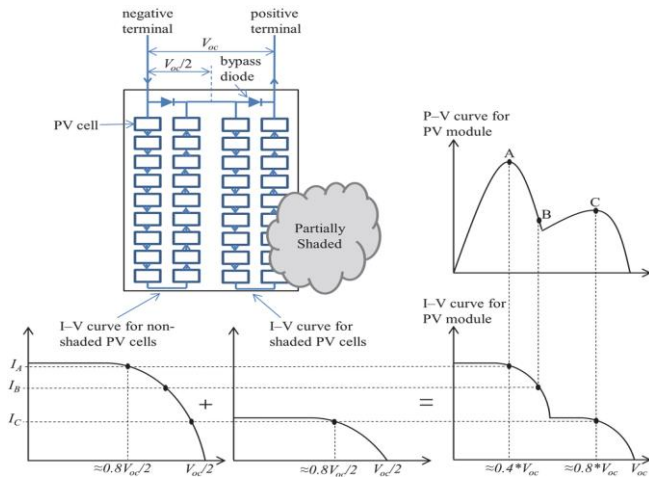
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III. REVIEW ON MPPT TECHNIQUE

The following mentioned various systems are broadly utilized Maximum Power Point Tracking strategies and connected on different Solar Photo voltaic applications such as space satellite, Water Pumping and various types of Application.

A. Modified Incremental conductance Algorithm

The Modified steady conductance calculation relies upon the slope of the Power –Voltage curve of the Photovoltaic model, it tends to be influenced by the sun based irradian level and ohmic changes of the load. In this computation uses the load change and voltage level of the Photo Voltaic module in the estimation. Subsequently, the impact of sun based illumination level and amphere changes because of burden and potential difference of the PV module should be thought on inside the algorithmic program. If there is no shade occur and likewise load obstruction stay consistent, no progressions made on the duty cycle. At the point when never shows signs of change happen in the sun based light level due to partial shading or any other factor like load, the estimation sets the standard inspiration to zero and after that picks the adjustments in the voltage and current degree of the Photo Voltaic module. If the computation perceive that both the changes are current and voltage characteristic on the Photo Voltaic Module, at that point the duty cycle is likewise expanded. Subsequently, so the incremental conductance algorithm is adjusted to beat the incorrect reaction during the expansion in sunlight based light level [30]. Utilizing these two qualities, the calculation decides the location of the operating point of the Photo Voltaic module in the characteristic of Poweer–Volatge curve.

B. Modified velocity based PSO algorithm

The C-Particle Swarm Optimization algorithm has a few parameters whose qualities should be selected by the researcher within a particular limit. The Particle Swarm Optimization additionally to boot use of random numbers within the rate equation that will makes the unpredictable result for Particle swarm optimization Technique. This gives plentiful degree to bring alterations into the predominant

PSO algorithmic to shape it further settled in nature with higher and sure outcomes. Introducing appropriate modifications may additionally create the Particle Swarm Optimization algorithmic rule far more economical in trailing the GMPP under PSC [6].This paper approach such type of modification to the Particle Swarm Optimization technique equation that increase the quality of the PSO technique, particularly for the case of GMPP under Partial Shading Conditions.

C. Current compensation Method

Solar Photo Voltaic Array constructed by multiple number of photo voltaic modules are associated in the way of series or parallel to get the maximum power from photo voltaic system and then fed into the power grid through an circuit breaker some electrical component like Transformer etc. , $SWout$, and capacitor $Cout$. A each PV module having the parallel connection of fly back converter. The configuration of the device is moderately changed by dynamic the auxiliary diode by an influence of MOSFET switch, SW $(i,j)2$ at the side of associate parallel diode this modifications are accustomed implement the planned theme. The transformers of the considerable number of converters are indistinguishable and have about equivalent charging inductance, $Lm(i,j)$. The capacitor output C is like a direct current supply for every of those rectifiers. Everywhere assortment of m number of strand within the array with every strand having n number of arrangement associated modules, it can be noted, by i and j during a generalized manner, whenever $i = 1{:}m$ and $j = 1{:}n$. Every fly-back rectifier works in two processes, traditional fly-back process and the resonant MPPT proess [7].

D. Enhanced Leader Particle Swarm Optimization

Enhanced Leader-Particle Swarm Optimization technique is associate degree joining of practical transformations on the quality PSO method to make extra arbitrariness in control factors. This type of technique was first projected by d , A. Rezaee in so very much misused as of late. Adoption this methodology is appropriate to the Maximum Power Point Tracking disadvantage with as in the extra changes not alone produce irregularity to free from nearby minima however accelerates the convergence process. Both the on top of aforementioned things are urgent for a bio traced technique once connected to MPPT applications. The iterative methodologies are pursued for update the atom position in look space by the random initialization. The higher fitness of particle is noted from the evaluated best particle (Pbest) of goodness .After that before mutation the velocity of the particle and also control variable position should be updated for the quality of Particle Swam Optimization technique. This kind of behavior is same as for the ELPSO and also conventional Particle Swarm Optimization technique. Therefore, the ELPSO method have the unique benefit for adopts different changes as for current worldwide best positions, for example, Gaussian, Cauchy, turn around and basic transformations. Toward the finish of the transformation procedure, one cycle finishes and a new leader i.e. the _best particle'emerges[8].Different transformations that help this method to accomplish global locations.

E. *Improved SuDoKu Reconfiguration Technique*

It is one of the rearrangement techniques for partial shading conditions that means there is no changes made on the circuit connections of the Photo Voltaic array but just changing the physical area of Photo Voltaic modules. For example the photo voltaic module number 25 is placed at the fifth row-third column of the Total Cross Tied Photo Voltaic array, however, it is bodily adjust to the subsequent line second segment in upgrade SuDoKu course of action without modifying any changes on the electrical circuit connections. In this manner, all Photo Voltaic modules in the Total Cross Tied Photo Voltaic modules are rearranged as indicated by the upgrade SuDoKu procedure. This empowers to disseminate the concealed PV modules from a similar column into various lines consistently above the PV exhibit. Therefore, output power of the Photo Voltaic array is increased under the same PSC [9].

F. *Intelligent Monkey King Evolution Algorithm*

In this method, A advanced evolutionary based algorithm was introduced for accurate and fast convergence at Maximum Power Point Tracking that is called intelligent monkey king evolutionary (IMKE), which is an advanced version of the MKE algorithm [37]. The MKE algorithm performance mainly depends upon the which Type of parameters are specified by the algorithm it has the good search space, Moreover, in most of the cases, the search of the global and local peaks are extremely near one another, it may be takes longer tracking time and also need large number of iterations to take care of issue circumstances and achieve the GMPP. Therefore, we have a tendency to brisk combining capacity are consolidated with MKE calculation, that has decreased the reliance on formula nominal parameter moreover as rapidly recognizes the GMPP. Besides, due to these enhancements, the Intelligent Monkey King Evolution algorithm speedily converges at MPP, just as the reliance on the underlying point worth and calculation of specified parameters are drastically reduced.

G. *Modified P& O Method*

Due to the some of the downside on the Conventional process First it is lead to transient behavior of around the MPPT condition by the continuous oscillation. Second, the Particle Optimization method is inclined to suffer its following supervision when the irradiance (G) increments quickly [11]. It means that suddenly changing the irradiance due the cloud movement and travelling of some object near the panel. Therefore introduce the Modified P & O Method in this method objective is to guarantee that steady state oscillation and therefore the deflection from the following locus is decreased. when hunting many perturbation cycles, the operative purpose ought to reach close to the MPP. By then the oscillation round the MPP get in to the result. it's recognize by associate degree perceptive check (which shall be represented later), wherever the desperation size is diminished to a base worth. victimization this procedure, the matter of oscillation is resolved.

H. *Shunt Series Compensation Method*

It is one of the methods for MPPT Technique under partial shading conditions some of the drawback is there the connection of By bass diode across each module. A) Power generation of the shaded module is totally lost. B) Tracking of MPPT is complicated due to multiple peaks of power and voltage characteristic [12]. Therefore in this method two compensations are implemented one is current-recompense converter that is associated in parallel with every module, another one is voltage-recompense converter. That is associated in arrangement with every strand. So this compensations are gives the every PV module to work at its exact MPP and convey supreme power.

I. *Enhaced Adaptive P & O Method*

In this methodology objective is to mitigate the restrictions of the standard Particle Optimization specifically, the steady state oscillation, diverged chase supervision, and incapacity to notice the global peak throughout partial shading. The above mentioned two problems are resolved by using A smart wavering recognition plot and a dynamic limit condition. For the moment, an intelligent prediction method is intended to guarantee that the global peak in every case effectively followed. Another element is the no-load voltage is resolved without utilizing sensors [19].

Table. 1 Comparison of Various MPPT Technique

Type of Technique	Advantages	Disadvantages
Grey wolf Optimization Technique [4]	Tracking speed is high, There is no transient oscillations, robust,	complexity, , Implementation cost is high
Artificial Bee Colony Optimization	Robust and simple, Minimum number of control parameters are used,	Tracking speed is slow, complex, It May fall on LMPP because of usage of minimum number of control parameters
Improved Curve Tracer	Simple construction , cost of the implementation is very cheap, there is no limitation for tracing under near Voc	Its May be comes in to LMPP

Simulated Annealing Algorithm	Converge accurately to GMPP, Minimum number of control parameters required	Computational complexity is occurs, Oscillate at the condition of MPPT, re-initializations are required due to the change in solar irradiance
Hybrid SA and P & O method	GMPP and LMPP are determined by using SA and P&O Method , Tracking speed and Performance is High,	Restart involve with change in weather condition, touch to progress the parameters of SA, suitable approach detection is difficult
Hybrid PSO and P & O	Minimum number of Search space is required , GMPP Tracking speed is high , Steady state oscillations are reduced ,	Complex control structure, implementation of experiment is very cost, Combination cannot be promise if GMPP located outside the search zone
Hybrid DEPSO method	Valid, system unconstrained, exact following under partial shading condition with high following rate	Composite calculation, More number of specification need to be selected for optimization

Table.2 Converter and controller Topology for various Techniques

Name of the Technique	Converter	controller
Modified Incremental conductance algorithm [30]	SEPIC Converter	PIC controller
Modified velocity based PSO algorithm [6]	DC-DC Converter	Not specified
Current compensation method [7]	Fly-back Converter	Not specified
Enhanced Leader Particle Swarm Optimization [8]	Boost Converter	Arduino controller
Intelligent Monkey King Evolution Algorithm [37]	Boost Converter	Dspace Micro lab box
Modified P& O Method [11]	Boost converter	Dspace controller
Shunt Series	Fly-back	Not specified

Compensation Method [12]	Converter	
Hybrid ELPSO – P&O Tracking Technique [8]	Boost Converter	Arduino Controller
New flower pollination Algorithm (FPA) Technique [22]	Boost Converter	Arduino Controller
A Modified P & O Technique [11]	Boost Converter	DSPACE Micro Lab Box
JayaDE Technique [34]	Boost Converter	DSPACE Micro Lab Box
Modified Beta Method [40]	Buck-Boost Converter	DSPACE Micro Lab Box
NHS based MPPT and PNKLMS based control Technique [3]	Boost Converter	DSPACE Micro Lab Box

IV. CONCLUSION

In this paper gives brief portrayals of various Present day MPPT algorithms and Techniques those are being utilized in programming package and experimental platform converter sand controller strategy of the MPPT Techniques are used under PSC conditions. This paper include some of the recent hybrid technology of MPPT. Many advanced Photo Voltaic circuit topologies are used to enhance the following execution of the PV system. In this paper Benefits and bad marks of different MPPT procedures are examined to select a reasonable MPPT under PSC. From the different methodologies discussed in this paper it is very confused to choose the which system is the best one. The decision of MPPT primarily relies on the kind of use, availability of hardware, cost, convergence time, proficiency of the system. It can be concluded that there is different number of research scope to choose a reasonable MPPT which can improve the yield effectiveness of PGS.

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