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A Review on Photovoltaic Module Based Grid Connected system

ShaurabhSen*,Dr. Dev Kumar Rai**
RGTU Bhopal, SVCE, Indore, MP India
Shaurabh.sirtex@gmail.com,devkumarrai@svceindore.ac.in***

Abstract: The Photovoltaic system gives useful energy when it is used with Inverter, termed as Grid connected technique. The main objective of this paper is to review for grid connected system for PV application and to increase energy efficiency by using renewable energy sources. Literature survey clear problem has been observed from inverter grid connected system. Therefore to review about different grid connected system and inverter, as well as improve battery lifetime extension and power enhancement.

KEYWORDS: PV, Inverter, Grid connected, distributed generators, Battery Storage System, etc.

I Introduction

Renewable energy is increasingly considered essential for meeting current and future energy needs [1]. Photovoltaic (PV) power, as it is clean and unlimited source of energy, is probably the best technology amongst all renewable energy sources and therefore a considerable amount of research has been conducted recently in this field. To better utilize the PV power, grid interconnection of PV system is needed. PV power rendering to the utility grid has been the fastest growing renewable energy technology by far since it attracted the attention of policy makers [2]
The increasing number of renewable energy sources and DG requires new approaches for the operation and management of the electricity grid in order to maintain or even to improve the power-supply reliability and quality. In addition, liberalization of the grids leads to new management structures, in which trading of energy and power is becoming increasingly important.
In grid connected inverter system, the power generated by Photovoltaic plant is directly given to the transmission line and it is distributed. Henceforth, the use of batteries and other energy storage devices is not required that makes the arrangement less space, reduced investment cost and maintenance than stand alone system. The evolution of solid state inverter techniques and its control strategy have established photovoltaic into the grid as shown in Fig. 1. Due to variation of input supply at the inverter side, the PV inverter topology and its control design is made robust with the promising contol structure. The dc-link voltage is fixed to supply constant voltage to the inverter.

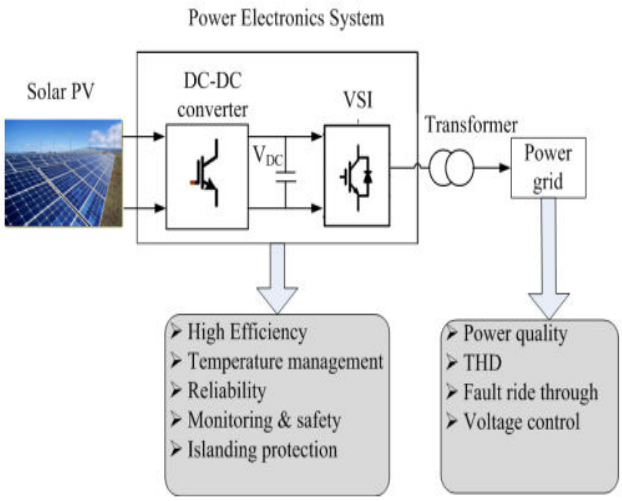

Fig. 1. Generic structure of grid connected PV system

As inverter uses many electronic types of equipment for inversion and control, it exerts unwanted sinusoidal components like ripple, harmonics due to PWM patterns. Hence Power quality is essential term when we deal with inverter system. So PV system should focus on these matters:

- Discontinuous Solar Irradiation during operation
- Non forecasted Climate condition
- Effect of temperature and ambient conditions.
- Islanding operation of PV system

The successful operation of inverter starts when PV module produces voltage to meet peak grid voltage. The useful voltage is obtained by connecting PV module in series and parallel. But inverter halts operation when PV modules voltage is less.

II Related Work

Genesis Alvarez, et.al, [1] done study in this paper, modeling a Grid-Connected PV System with MPPT Controller technique, the focuses on performance analyzing and dynamic modeling of the current grid-tied fixed array 6.84kW solar PV technique located. A battery energy storage (BES) scheme is designed and applied to improve the stability and reliability for system. An

overview of the entire system and its PV module are presented. In addition, a grid connected PV with Maximum Power Point Tracking controller. The simulation results show the effective of the proposed method. The different methods applied in MPPT were evaluated such as INC and P&O. BESS was designed to smooth the PV array output. The calculations, a lithium-ion battery with the capacity of 4kW was selected and integrated with the Photovoltaic. The simulation results show that the Photovoltaic/Battery dynamic model works properly and the system has reasonable reactions to the environmental and technical changes.

H. BOUMAARAF, et.al, [2] in this paper, performance the modeling and control of grid connected PV technique. The photovoltaic (PV) connected to the grid using a Voltage Source Inverter. A photovoltaic generator and to match the solar cell power to the environmental changes of buck-boost inverter controlled by the fuzzy logic control command is used for the grid connected inverter is desirable to provide the unity power factor. Grid connected photovoltaic technique using a two level inverter in which can synchronize a sinusoidal current output with a voltage grid is shown by the numerical simulation. Fuzzy logic MPP tracking controller is used to control the buck-boost in order to extract the maximum power from the photovoltaic array generator. The use of fuzzy logic controller can improve the efficiency of the overall system by minimizing the energy losses when the change of irradiation is frequent. The results show good performance of the control system and confirm the effectiveness of the proposed photovoltaic generation system for any operating condition.

G. Carannante [3], in this paper, the performance PV power depends on local irradiance conditions. The PV are sometimes subject to partial shading, in which may produce a nonideal characteristic curve, presenting true and local power maxima in the PI curve. In traditional of MPPT can converge to local maximum, in which is not the true maximum power point. In this paper investigates the effects of non-uniform solar irradiance distribution of a photovoltaic source. The MPPT method that is able to optimize the source instantaneous operating power under non-uniform irradiance is proposed. The ability of the algorithm and its increased performance through respect to traditional algorithms are evaluated through means of experimental tests performed on a real PV power system. Algorithm was tested on a real photovoltaic source of 4 kWp, operating under inhomogeneous irradiance. The results of the tests focused on the technique in individuating the instantaneous true MPP, also in the presence of local maxima. A comparison of the proposed and alternative MPPT method evidences how accuracy and speed can significantly impact the energy produced by the PV source.

F.Bouchafaa et.al, [4] propose an intelligent control technique for the maximum power point tracking of a PV system under variable temperature and insulation conditions. This method uses a fuzzy logic controller. It can be deduced that the fuzzy controller is fast controller in the transitional state and presents also a much smoother signal with less fluctuations in steady state. It was able to find the point of maximum power in a shorter time runs

AshishPandey [5], the investigation this paper, the power available at the output of solar arrays keeps changing with solar insolation, ambient temperature. Expensive and inefficient, the solar arrays must be operated at MPP continuously for economic reasons. Of the numerous algorithms for this purpose, perturb and observe is a standard. A derivative of gradient ascent method used in the optimization theory, this algorithm introduces a tradeoff between tracking and dynamic. This technique also has a tendency to drift the system away from the maximum power point as atmospheric conditions change. In this paper addresses both the issues. A variable-step-length algorithm is proposed to eliminate the tradeoff. In the drift is minimized by evaluating the entire trend in a power versus voltage curve. Analytical results, validated on a prototype system show excellent performance. Solar MPPTs cater to wide-ranging applications. For the rooftop, FulCurvE, or hybrid algorithms can provide an excellent MPPT solution. Overall, the hybrid algorithm provides an excellent MPPT solution for all types of applications.

F. Huang et.al, [6] a microcontroller based automatic sun Tracker was designed and implemented. The automatic sun tracker is implemented with a dc motor and a dc motor controller. The novelty of this unit is that the switching device of the chopper is not only used for power conversion but also for Maximum Power Point detection. The Maximum Power Point is determined by simple embedded software with a current sweep approach.

Amrouche, et.al, [7] proposed artificial neural network, (ANN) based modified P&O method to predict the power value during the next perturbation cycle so that the value of perturbation step can be adjusted for next perturbation cycle.

III Conclusion

In this review paper of grid connected inverters which covers the inverter operation in terms of circuit simplicity, application, robustness, and ease of implementation in MATLAB. Single stage inverters which are generally centralized in pattern should be given less preference because of amplification and PV character mismatching. For low power application VSI technique is preferable.

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