Volume-4, Issue-7, July-2015 • ISSN No 2277 - 8160

Research Paper Engineering

To Study About Photovoltaic Grid Connected Inverter With Current Control Techniques

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ABSTRACT

Various types of renewable energy systems work in combination with the existing electrical grid. During PV (Photovoltaic) grid connected inverter system, quality of power quality is main subject. The assessment of inverter is developed with focus on low cost, high reliability, and mass-production for converting electrical energy from the PV module to the grid system. Now a day numerous types of inverter topologies are present, compare and evaluated against demand, component rating. PV inverter connected system to explain electrical performance subjected to different operating condition. In this paper present adaptive hysteresis technique for solar PV system grid connected inverter to compensate the current related problem. Generally the adaptive HCC (hysteresis current control) technique is changes the hysteresis band width according to modulation frequency, dc capacitor voltage, and supply voltage and reference current wave. The HCC is also determining the switching paten of the shunt active power filter.

KEYWORDS : Inverter, Power quality, Grid, photovoltaic, adaptive hysteresis

I. INTRODUCTION

In our country nationalized power generations systems are facing the identical constrains of shortage of fossil fuel and require reducing emission. During the Long transmission lines are one of the main problems for electrical power losses. Therefore, significance has improved on distributed generation network with integration of renewable energy systems into the grid, which guide to reduce in emission and energy efficiency. Increasing of the renewable energy saturation to the grid, PQ of the medium to low voltage power transmission system is becoming main area of interest [1]. The majority of renewable energy integration systems to the grid take place with the aid off power electronics converter and inverter.

Recent year solar energy (renewable energy) can be used as a substitute resource due to the worldwide crisis on fossil fuel and increasing worry about worldwide environment problems. Recently photovoltaic is widely used because basically its works to convert solar energy into electricity directly. Through nonlinear characteristics, concerning loads to PV will problems the power generated by PV is not maximum. One more important issue is due to cost of PV arrays is high. There are numerous problems when photovoltaic connected grid with inverter, another problem is current fluctuation. Generally PV applications can be classified into two stages, stand-alone and grid-connected systems. The first stage stand-alone application is where PV systems are separated from utilities and the second stage applications where PV and grid are integrated [2].

III. GRID CONNECTED PHOTOVOLTAIC GENERATION SYSTEM

PV generation system of grid connected is mostly composed of the PV array; the inverter device with the function of MPPT (maximum power tracking) and the control system, whose structure illustrate in Figure1 [4].

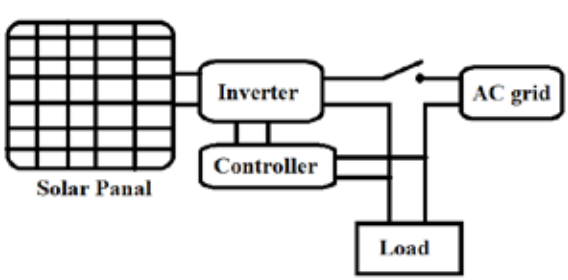

Figure1 Power Generation structure of Grid connected Photovoltaic System

The basic function of the inverter MPPT can connect to the grid and inverse the electric power into sinusoidal current [3]. Generally the control system control the maximum power point tracking of PV, current waveform and output power grid-connected inverter, which makes the output to the grid correspond with the export by PV array.

V. VOLTAGE SOURCE INVERTER CONTROL METHOD

The basic working of the photovoltaic array voltage is set to Ed, the standard voltage Edr should be corresponding with the working voltage Ed whereas the PV array is in the maximum power output state. The standard current should be behave like sinusoidal at the same time as the power factor should be kept to one which can be performed by PWM control method. Here Sw is a switch; the switch generally protects the inverter and also cuts the inverter from the system while the system is power off. The general block diagram of the VSI (voltage source inverter) and its control method are illustrated in Figure2 [10].

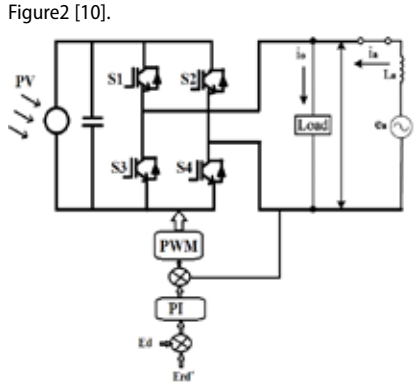

Figure2 Basic Structure of Voltage Source Inverter

From illustrated in figure 2, the general process of inverter control system is quite complex which used the earlier class system fluctuations voltage and waveform distortion signal to control the next class system. To confirm power supply, the switch of inverter output will generate frequency management controlling is complex and difficult. It will raise the difficulty of the controlling system of the main circuit if situation another AC switch; momentarily the single phase system will have a big power fluctuation.

VI. CURRENT CONTROL TECHNIQUES

The current controller mostly used for obtaining triggering pulse as per the reference value. Now we discussed only the current control method. Essentially the numerous techniques for nonlinear current

control like Dead-Beat control, Predictive control and Hysteresis control which techniques is discussed in below:

Dead-Beat Control:

Dead-Beat control mean, "While the selection of the voltage vector is prepared to a zero (null) error among a one sample delay, the predictive controller called dead beat controller". In this control system, among the additional information is given to the controllers like non-available state variables like flux and speed can also be included. Appropriately, observer or other control blocks are necessary to determine all these variables which often may be shared in the control of the complete scheme.

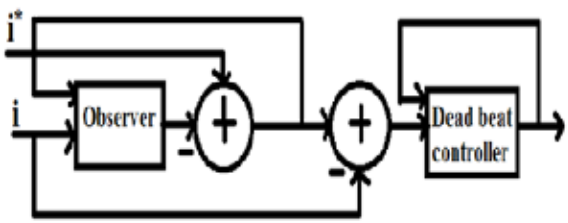

Figure3 Basic Block Diagram of Dead-Beat Control

In this control system has a sample delay time, as it regulates the current while it achieves its reference at the end of the next switching period. In this type of case, the controller indicates one sample delay time. In several cases similar to [6] a viewer can be used by controller to make difficult this time delay which is illustrate in figure 3. Dead-beat controller is simple controlling, fast response and it is suitable for microprocessor-based application [5].

Predictive Control:

Predictive control is current controller principal; it is one of the non-linear grid connected controllers. The controlling strategy of predictive control is based on the fact that only a finite number of possible switching states can be achieved by a static power converter, and in addition the models of the system can be used to predict the performance of the variables for each switching states. Thus to choose the appropriate switching state to be applied, a selection principal must be defined. These types of switching sates selection principle is expressed as a quality function that will be evaluated for the variables predicted values to be controlled. Prediction control of the expatiation value of these variables is calculated for all possible switching state. The lessen the switching state that the quality function is also selected.

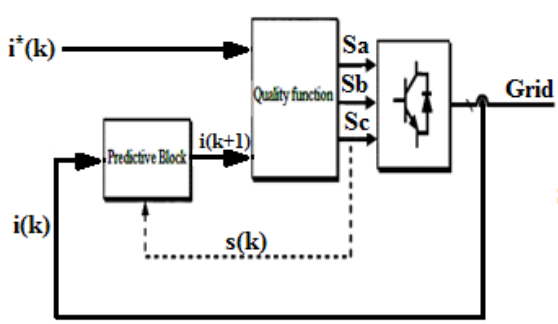

Figure 4 Basic Idea of the predictive control

Illustrate in figure 4, a control of predictive current block is applied to determine the next value of the output current by using the available output current. Consequently, the quality function determines the error between the predicted output current and the reference current. Finally, the voltage which minimizes the current error is chosen and applied to the output current. In the predictive model system type of controller is known for their possibility to consist of nonlinearities of the system. This type of controllers provides a better performance as the mathematical model is accurate, linear and time invariant. While complex computationally of the predictive controller, controller wants a large control loop time period.

Hysteresis Control:

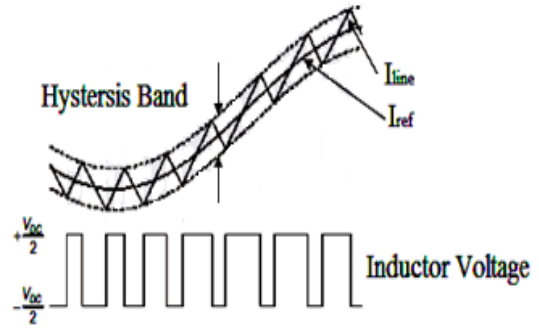

Figure5 Controlling action of Hysteresis control Method

Hysteresis current control is a VSI (voltage source inverter) controlling method to force the grid injected current follows a reference current. In this control system the reference current and line current are used to control the inverter switches. Lower and upper hysteresis band limitations are associated to the minimum and maximum error directly. If the changed the reference current, line current has to wait within these limits. This error signal range directly controls the amount of ripples in the output current from the inverter which is called the hysteresis band. The ramping of current between the two band limits is illustrated in figure 5. Hystereses controllers are not only are robustness and simple but also have a good transient response. As a result between the phases, the current error is not limited to the value of the hysteresis band. Hysteresis controller changes the switching frequency by load parameter's variations which is changed the bandwidth and it can reason resonance problems. In addition, the losses of switching resist the application of hysteresis control to lower power level. In this type of problems can be solved by applying variable limitation as mentioned in [7]. However, it needed system parameter's details.

VII. CONCLUSION

Chang of weather and pollution are reasons to reduce our use of oil, coal and natural gas. On the other hand, the atmosphere is not the only the reason to replacement the fossil fuel sources with renewable. Absolutely, when fossil fuels are free from pollution for any reason, they would still be issue big problems for modern society. Renewable energy is very flexible since of renewable energy can be used in small systems for distributed generation for centralized generation. As the mostly of renewable energy systems are connected to the grid, hence using controlled inverter is necessary to have a safe and reliable grid interconnection. So, this type of the current control inverter is more commonly used, and then in this paper present the structure of the important current control techniques like hysteresis, predictive and dead beat control were described. Lastly, their ability to give a high power quality generation to the grid was explained. Shown the different current control technique explain in this paper, we concluded that the issue of current hysteresis control technique is appropriate and easy to implementation.

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