REVIEW OF GRID TIED SOLAR PV WITH VOLTAGE DROP CONTROL TECHNIQUES FOR DC MICROGRID

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Abstract- This work present a closed-loop method is applied to control the multilevel inverter which injects power into the grid. The voltage and current controls are implemented for controlling the system by using Droop control, master slave control and average current sharing control. Among them Droop control techniques is very popular due to better communication and quick response. A Maximum Power Point Tracking control is executed using perturb and observe (P&O) method is employed to control boost converter. A closed loop control method is applied to insert power into the grid using multilevel inverter. DC link voltage control and current control is used to controlling multilevel inverter. The resulting system is able to collect maximum power from the Photo Voltaic system under different operating conditions. To compare all the different types of voltage control techniques and try to find out the best solution of current sharing of different paralleled converters and also smooth operation with microgrid.

KeyWords: Grid tied PV System, DC microgrid, conventional droop control, master slave droop control.

1. INTRODUCTION

Now a days, clean and sustainable power demand increasing due to this Solar and wind both are effective power generation. From all renewable power system the photovoltaic generation method is effective and can easily be implemented. The power generation from the PV system have variable outputs which depending on the operating condition of temperature and irradiance. There are several MPPT methods available to extract the maximum power from a photovoltaic array, including incremental conductance (INC), perturb and observe, or P&O, and many others. All in all, the method perturb and observe has certain benefits and is frequently used in photovoltaic applications.By incorporating a boost converter, this MPPT controller maximizes power extraction in all irradiation circumstances. The PV system's output acts as the inverter's DC link. PV system synchronization with grid is achieved through the use of a power controlling method [1].

Typically, a grid connect photovoltaic system consists of two stages, One is primary power stage and other is the second stage. This system is consists of current control through inverter, which regulates the current entered into the grid, and the first requirement is that DC voltage control, which used to a constant DC link voltage across the inverter input. Many reference frames can be usedto control the current. The suggested system uses a proportional integral (PI) controller with synchronous reference frame [2].

2. SOLAR PHOTOVOLTAIC ARRAY

The arrangement of solar panels are in series and paralleled which is known as solar PV array, to produce required power. As per shown in fig. the small size of component of the solar photovoltaic array is called PV cell. The corresponding circuit in Fig. 2.1 illustrates the solar photovoltaic cell in its perfect configuration. One module is made up of several 36 or 72 cells arranged in series. This is divided into multiple modules that make up the form array's single structure. Finally, in order to obtain necessary power, all of the photovoltaic arrays are arranged in parallel. Resistance in series (Rs) is comparatively more prevalent in the PV module, and the optimum value of Rsh is regarded as infinite. The PV cell's open

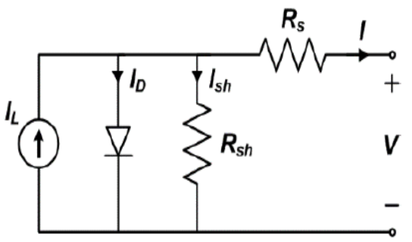

Figure 2.1: PV cell Equivalent circuit [1]

circuit voltage (Voc) is directly correlated with solar radiation and inversely correlated with temperature [3].

The Array of PV characterized on the based I-V and the P-V characteristic. Fig2.1 and fig 2.3 shows the variation in irradiation result variation in current and curves of I-V characteristic vary mainly for the different level of the irradiation. Irradiation straight affects to the PV Array current while change of the temperature straightly affects to the voltage generated by PV Array as per Fig. 2.4 and the Fig. 2.5. So the same observation made from below graphs of the I-V and the P-V characteristics of different temperature level and irradiation [4].

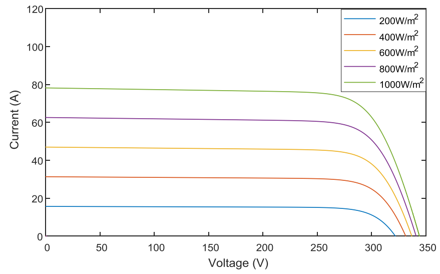

Fig. 2.2 I-V characteristics PV Array at the different irradiation level [4]

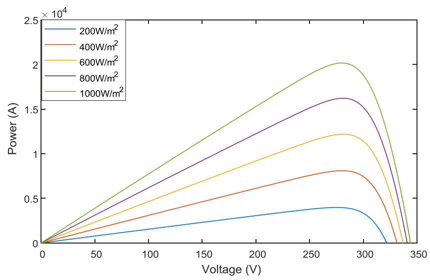

Fig. 2.3 P-V characteristics PV Array at the different irradiation levels [4]

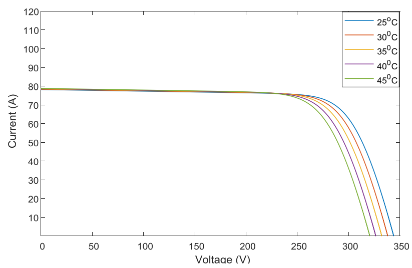

Fig. 2.4 I-V characteristics PV Array at the different temperature level [4]

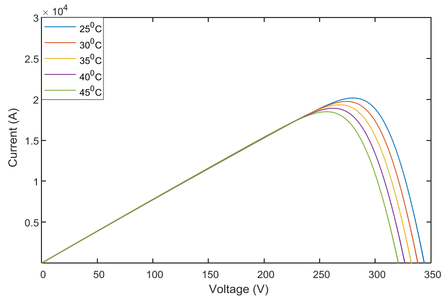

Fig 2.5 P-V characteristics PV Array at the different temperature level [4]

3. TRACKING FOR MAXIMUM POWER AND BOOST CONVERTER

To boost required DC voltage boost converter are used with Incremental conductance algorithm.

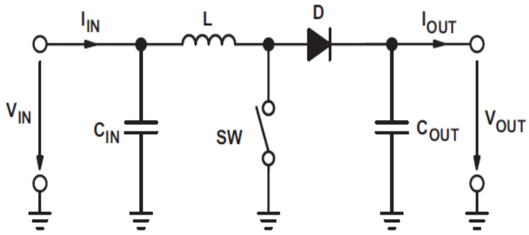

Fig. 3.1 Boost Converter [5]

An algorithm generates the duty cycle to control the switch used in boost converters. The switching frequency set a 20 kHz in PWM generator. Fig. 3.1 shows design of boost converter [5], [6] [7]. Many advantages can be gained by paralleling the power source in the microgrid application through the power electronics module instead of using a single system high power converter [8].

4. CONTROLLING METHOD FOR THE PARALLELED CONVERTER

There are so many method are applied for control the converter which are connected in parallel. Two main methods are master slave and the voltage droop control. In this section some discriminations of each methods will be shown [9].

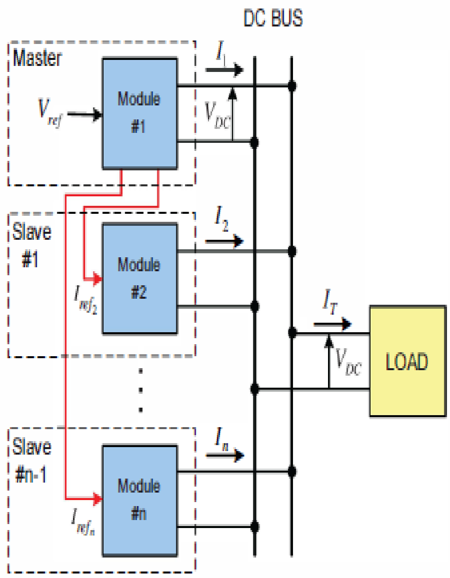

Fig. 4.1 Master Slave voltage droops control [10]

As shown in the fig. 4.1 the block diagram of master slave control system that all the given block is composed by the dc source, the static converter and static controller [10]. The 1st block is the master module of controls the grid dc bus voltage whereas the other (second) block is the slaves that are the current controlled. Load sharing can be completely controlled. Fast communication channels are needed to given reference currents for the slave converters deliverd by the master block, which is the main drawback of this control scheme. The entire system can be shut down if communication links are lost and master blocks malfunction. The system must be designed with some degree of dismissal to prevent and reduce the likelihood of failure. [11].

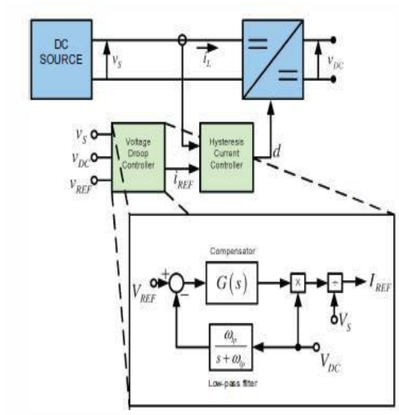

Fig. 4.2 Schematic diagram of the voltage droop control technique [12]

The diagram depicting the voltage droop control system can be found in Fig. 4.2. The converter's impedance behavior is emulated by each droop controller, which results in the converter output voltage being lowered and the current supplied increasing by 12 to 13 volts.
The current flowing between the paralleled connected converters linked in the DC micro grid is facilitated by this policy without the need for a central control system. For rapid dc bus voltage and cut-off harmonic frequencies [15], [16], [17], the use of low pass filters is necessary.

5. PI CONTROL

To monitor the converter characteristic of photovoltaic level, it's possible to observe the negative slope (-ve) of the voltage droop control system. The performance of parallel converters linked to a DC micro grid will be examined using two different types of controllers: (P) proportional and (PI) proportional-integral. The P controller's informal implementation is not preferred because it causes steady-state errors when changing steps according to the signal. The integral characteristic of the compensator experiences a lower load sharing when the converter uses a proportional integral controller.

6. CONCLUSIONS

Different voltage control methods are discussed in this paper. In contrast, the PI controller showed a fast response, while the proportional-integral (PI) gives more effective power regulation with a zero steady-state error. The load sharing characteristic of both proportional (P) and proportional-integral (PI) controllers was good. Communication between the master and slave units can be lost by the master slave voltage droop control method, which has some disadvantages. The voltage droop method has been shown to be an effective way to flow of currents between different types of converters without the use of a central controller. Based on the primary results, it appears that this type of control is perfect method for integrating distributed energy sources into a microgrid. This method is easily share current between parallel converters connected in the DC micro grid without the need for central control.

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