

## Design of the PWM Inverter Photovoltaics Tracking System for Maximum Efficiency

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**Abstract.** Since output of solar cell is direct current type, to apply ac load in the solar cell, inverter among power converters has to be necessarily installed in the solar cell. Power converter system was constructed with booster chopper and voltage source inverter and test was carried out for both devices. Constant voltage control method was used to track a maximum power point at boost converter control. In this paper, a boost chopper using photovoltaics system and PWM voltage type power converter were constructed to provide a pleasant environment to the patients in the hospital wards by controlling temperature, humidity and air-conditioning & heating.

**Keywords:** Solar cell, inverter, power converter, booster chopper, PWM

### 1 Introduction

PWM modulator should perform a stable modulation even if disturbance such as distortion or noise in grid source voltage waveform which is synchronizing signal is included. Besides, when synchronizing signal and control signal are processed by microprocessor, time difference is existed between sampling timing and carrier wave, thus compensation method is required for this time difference.

A parallel connection system refers to a system wherein photon is always electrically connected. Whereas, a grid change-over system refers to a system which enables reverse power transmission of surplus power which is generated by

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<sup>1</sup> Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

photovoltaics.

When PV system is applied in the houses and small-scale loads, these systems are largely relied on the area and weather. Therefore, in the present study, it was intended to develop an energy saving type source combined power supply unit to obtain power saving effect by around 10~20[%] by linking it with utility line to overcome shortcomings of not generating power continuously and independently.

In this thesis, we intended to control boost chopper so that maximum output point can be always tracked regardless of insolation and temperature changes by changing time ratio based on the power comparison after constructing a grid connected photovoltaics system as voltage type inverter.

### 1.1 Parameter of PV Cell and V-I Characteristic curves of Solar Cell

Output voltage of a solar battery has almost uniform light and Open Circuit voltage of a solar battery has output of 0.5~0.6V. Short Circuit Current increases linearly about light and it is reasoned that charging carrier produced by light is proportional to light. Thus, Short Circuit Current of solar battery is very useful about measuring illuminance.

MPP is written in VMPP, IMPP and PMPP Smart Grid Photovoltaic Generation Trainer Value of voltage and current is Nominal in a solar battery. Nominal current Short-circuit current are little different, and solar battery has Short-circuit current internal force. Solar battery also can be phase of Short-circuit. The below figure 1 represents MPP characteristic curve.

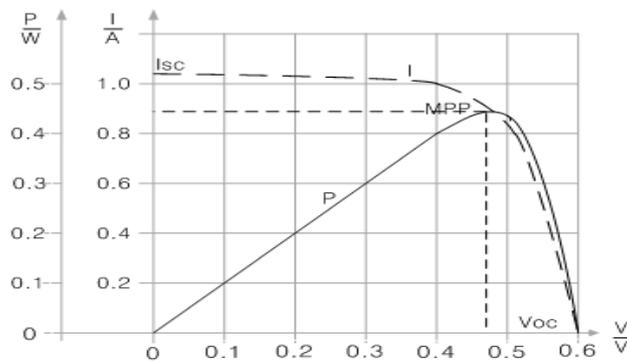


Fig. 1. MPP Characteristic curve

### 1.2 Maximum Power Point

The output power of the solar cell is the product of the voltage and current applied to the cell. In general, power is via the load (+) sign, the power consumed by the solar cells is (-) to be regarded as a sign. Some characteristic points in the power can be written as equation (1).

$$P = V \times I = V[I_L - I_0(e^{\frac{qV}{kT}} - 1)] \quad (1)$$

## 2 Configure Grid-Connected Power Converter

Grid-connected inverter utilizes a Commercial Systems to maintain a balanced power between DC power and AC load, the electric power insufficient for the load is low the output of the inverter than the power required is automatically supplied from the commercial system, If the load is greater than the power output of the inverter that requires that the excessive power is supplied to the grid line to be supplied to the other load of the system board. Therefore, without the need for expensive and inefficient storage battery for storing the DC power from alternative energy sources such as solar cells or fuel cells, even at night or in rain can always supply power to the load. In addition, the inverter output and By installing a insulating transformer, isolating transformer between the grid lines can be electrically insulated to prevent leakage of the DC component of the system when the internal side of the DC power supply side accident occurs, and the system transformer itself by the series impedance contribute to lower below the allowable harmonic currents injected into the line facilitates the interface of the inverter and the grid line voltage.

## 3 Result

In the present study, PV tracking system was constructed for air-conditioning & heating in the hospital wards. Since output of solar cell which is a dc source is relatively low, PWM voltage source inverter was constructed using a boost chopper having a low capacity dc voltage to operate all the loads inside of hospital including temperature sensor and humidity sensor.

## References

1. Young-Choon Kim, Moon-Taek Cho, Ho-Bin Song, Ok-Hwan Kim, "Regeneration Break Control in the Hig-Speed Area using the Expending of the Constant Torque Region and Power Region", International Journal of Control and Automation, vol.6, No.4, August, pp.347-356,(2013)
2. Young-Choon Kim, Ho-Bin Song, Moon-Taek Cho, Chung-Sik Lee, Ok-Hwan Kim, Sung-Young Park, "A Study on the Improved Stability of Inverter through History Management of Semiconductor Elements for Power Supply", GST 2012, CCIS 340, DOI:10.1007/978-3-642-35267-6\_20,pp.155-162,(2012)
3. Young-Choon Kim, Ho-Bin Song, Moon-Taek Cho, Suk-Hwan Moon, "A Study on Vector Control System for Induction Motor Speed Control", EMC 2012, DOI: 10.1007/978-94-007-5076-0\_73, pp. 599-812, (2012)