MULTILEVEL INVERTER

Mrs. T. Gohila[1] M.Tech., AsP/EEE,

Dr. R. Satish Kumar[2], M.E, Ph.D., Principal/SCE,

Mr. N. Manoj Prabakar[3], Mr. T. Vignesh[4], Mr. T. Soundar[5]

Associate Professor[1], Student[345], Final Year Department of EEE, Sengunthar Engineering College, Tiruchengode, Tamil Nadu,India.

ABSTRACT

In this paper, a multi level inverter with MPPT for PV application is proposed. The proposed MPPT based multilevel inverter generates multi-level ac output voltage when we give the appropriate gate signal's design. The multilevel inverter is fed from a PV cell through a boost converter whose control is based on MPPT.

The total harmonic distortion can be reduced by using a low pass filter. In this topology the switching losses and voltage stress can be reduced . The operating principle of the proposed inverter and the voltage balancing method of input capacitors are discussed. The multilevel inverter is controlled with sinusoidal pulse-width modulation (SPWM).

Keywords:*multilevel inverter; packed u-cell; power quality; multicarrier pwm; renewable energy conversion*

INTRODUCTION

The power grid has encountered high energy demand since last decade due to increasing number of consumers as well as high power industries. Power electronics equipment is replacing conventional bulky transformers significantly because of the developing technology of the semiconductor devices.

Power inverters are widely used in renewable energy conversion systems to deliver green power to the customers. Economic costs of power switches make them profitable to manufacture and allow them to compete in the market.

EXISTING SYSTEMS

In recent days the research on multilevel inverters has been widely increasing due to its capability of high power medium voltage application.

In low level inverters the harmonic content of output current can be reduced by increasing the switching frequency.

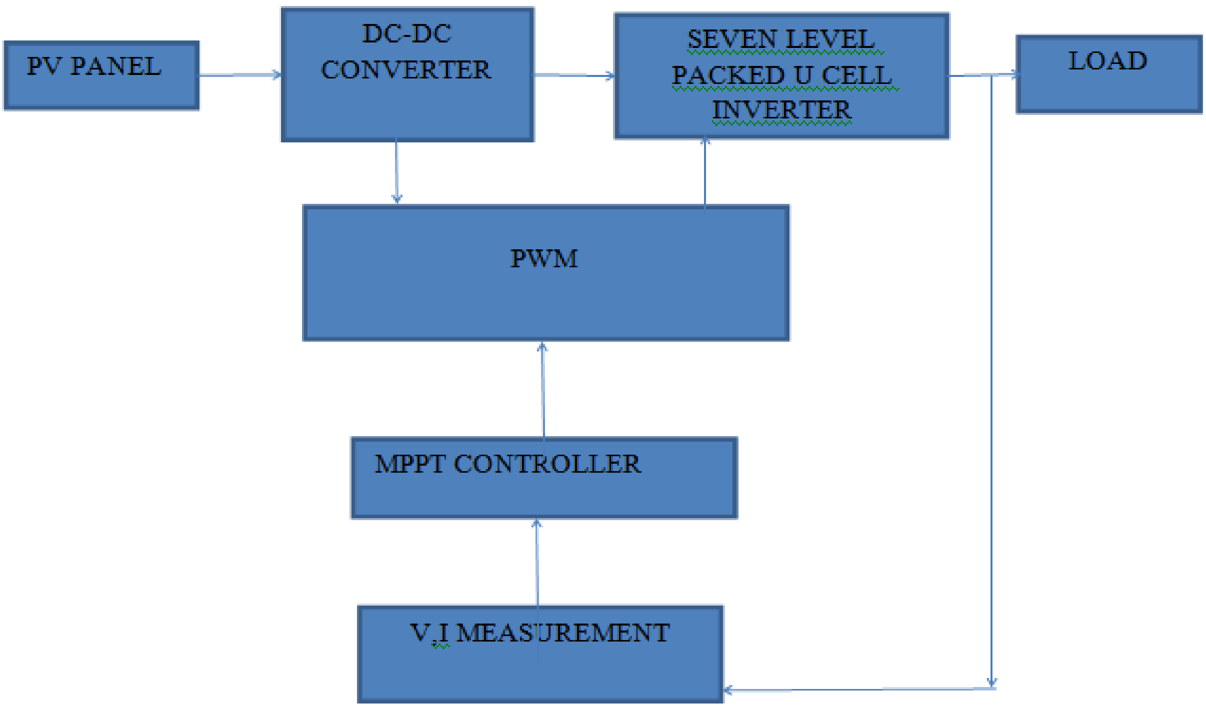
But the switching frequency is restricted by switching loss in high power and high voltage applications. In such applications multilevel inverter has been used.

PROPOSED SYSTEM

The introduced inverter generates multi-level AC voltage at the output using two DC links and six semiconductor switches. Comparing to cascaded H-bridge and neutral point clamp multilevel inverters, the introduced multilevel inverter produces more voltage levels using less components.

The proposed inverter is used in PV system where the green power comes from two separate PV panels connected to the DC links through DC-DC converters to draw the maximum power. Due to boost operation of this inverter, two different PV panels can combine and send their powers to the grid.

BLOCK DIAGRAM



WORKING PRINCIPLE

PV PANEL

Solar cells convert light energy into electrical energy either indirectly by first converting it into heat, or through a direct process known as the photovoltaic effect. The most common types of solar cells are based on the photovoltaic effect, which occurs when light falling on a two-layer semiconductor material produces a potential difference, or voltage, between the two layers. The voltage produced in the cell is capable of driving a current through an external electrical circuit that can be utilized to power electrical devices.

MPPT CONTROLLER

Maximum power point tracking (MPPT)[1][2] or sometimes just power point tracking (PPT)[3][4]) is a technique used commonly with wind turbines and photovoltaic (PV) solar systems to maximize power extraction under all conditions.Although it primarily applies to solar power, the principle applies generally to sources with variable power: for example, optical power transmission and thermo photovoltaics.PV solar systems exist in many different configurations with regard to their relationship to inverter systems, external grids, battery banks, or other electrical loads.[5] Regardless of the ultimate destination of the solar power, though, the central problem addressed by MPPT is that the efficiency of power transfer from the solar cell depends on both the amount of sunlight falling on the solar panels and the electrical characteristics of the load. As the amount of sunlight varies, the load characteristic that gives the highest power transfer efficiency changes, so that the efficiency of the system is optimized when the load characteristic changes to keep the power transfer at highest efficiency. This load characteristic is called the maximum power point (MPP) and MPPT is the process of finding this point and keeping the load characteristic there. Electrical circuits can be designed to present arbitrary loads to the photovoltaic cells and then convert the voltage, current, or frequency to suit other devices or systems, and MPPT solves the problem of choosing the best load to be presented to the cells in order to get the most usable power out.

Solar cells have a complex relationship between temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve.[6][7] It is the purpose of the MPPT system to sample the output of the PV cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions.[8] MPPT devices are typically integrated into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving various loads, including power grids, batteries, or motors.

MODIFIED PACKED U-CELL INVERTER

Multilevel inverter has wide application in high power industries due to the high voltage and low harmonics. Since there are various types of multilevel inverters, due to reduction in number of switches and low switching losses compared to the others type of inverters we used here is Packed U Cell type multilevel inverter. This is called as Packed U cell because of the arrangement of one capacitor and two power switches. It provides energy conversion in high quality using a small number of power semiconductor devices and capacitors in which the production cost is reduced. The sinusoidal pulse-width modulation has been adapted as technique for seven level PUC inverter. Here the modeling of single phase and three phase seven level PUC type multilevel inverter for open and closed loop control with various types of load are designed and waveforms are shown below. The closed loop is designed with PI controller and the THD analysis is done with the filter. The input voltage source is also replaced by the photovoltaic cells with MPPT technique which provides renewable power generation.

PWM TECHNIQUES

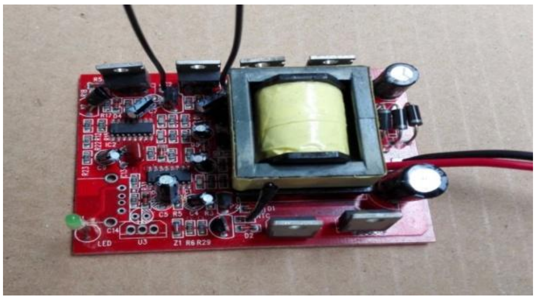
The output voltage of a voltage source inverter, can be adjusted by various methods such as external control of AC voltage on the output side of VSI, external control of DC voltage on the input side of VSI and internal control within the VSI. The most efficient method of internal control of VSI is by a PWM control technique used within the inverter itself. In the PWM method, a constant input DC voltage is applied to the inverter and a controlled AC output voltage with frequency is obtained. It is accomplished by adjusting the turn on and turn off periods of the inverter switching devices. Because of the advances in power electronics devices and modern digital control systems, the PWM inverters are used in various industrial applications to convert DC to AC and deliver AC power with various voltage and frequency levels to the load or motors. The energy that a PWM inverter delivers to a motor is controlled by the train of PWM control signal to the gates or the control terminal of the power electronics devices.

DC SOURCE

DC sources refer to sources of electrical energy which are associated with constant voltages and currents. A DC power supply can be constructed as an electronic.

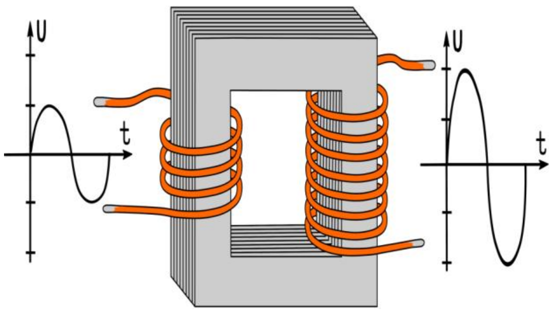
INVERTER

Inverter is a power electronic device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry.



TRANFORMER

Transformer is a device that is used to either raise or lower voltages and currents in an electrical circuit. In modern electrical distribution systems, transformers are used to boost voltage levels so as to decrease line losses during transmission.



CONCLUSTION

In this paper a reconfigured PUC inverter topology has been presented and studied experimentally. The proposed MPUC inverter can generate a seven-level voltage waveform at the output with low harmonic contents. The associated switching algorithm has been designed and implemented on the introduced MPUC topology with reduced switching frequency aspect. Switches' frequencies and ratings have been investigated experimentally to validate the good dynamic performance of the proposed topology. Moreover, the comparison of MPUC to the CHB multilevel inverter showed other advantages of the proposed multilevel inverter topology, including fewer components, a lower manufacturing price, and a smaller package due to reduced filter size.

REFERENCES

1. Bose, B.K. Multi-Level Converters; Multidisciplinary Digital Publishing Institute: Basel, Switzerland, 2015.
2. Mobarrez, M.; Bhattacharya, S.; Fregosi, D. Implementation of distributed power balancing strategy with a layer of supervision in a low-voltage DC microgrid. In Proceedings of the 2017 IEEE Applied Power Electronics Conference and Exposition (APEC), Tampa, FL, USA, 26–30 March 2017; pp. 1248–1254.
3. Franquelo, L.G.; Rodriguez, J.; Leon, J.I.; Kouro, S.; Portillo, R.; Prats, M.A.M. The age of multilevel converters arrives. IEEE Ind. Electron. Mag. **2008**, 2, 28–39. [CrossRef]
4. Malinowski, M.; Gopakumar, K.; Rodriguez, J.; Perez, M.A. A survey on cascaded multilevel inverters. IEEE Trans. Ind. Electron. **2010**, 57, 2197–2206. [CrossRef]