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Output Enhancement Due To Mechanism of Electrical Inverter

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ABSTRACT

Electrical inverters are electrical devices designed to convert direct current (DC) to alternating current (AC). DC is the power that is produced by batteries and solar panels while AC is the standard power needed to run electrical equipment. A power inverter does the opposite of a rectifier and is used in places and situations where AC power is not available. As the mechanism of inverter gives soundless and pollution less output than a generator, therefore a study of enhancement of output due to new technology mechanisms of electrical inverter is important for economic and smooth supply of electricity.

KEYWORDS : Modified sine wave, solar inverter, output enhancement, boost inverter

1. INTRODUCTION

Electrical inverters produce one of three types of power wave signals. Each signal represents a quality of power output. The first set of inverters made which are now obsolete produced a Square Wave signal. Square Wave signals produced power that was not reliable or consistent. The second wave signal is the Modified Square Wave also known as the Modified Sine Wave. Modified Square Wave Inverters are the most popular and produce efficient stable power that can run most standard electrical equipment. Pure Sine Wave inverters produce the most reliable and consistent power wave signal. This makes them the most expensive to acquire. Some equipment that are sensitive such as rechargeable tools and medical equipment require Pure Sine Wave inverters.

Basic electrical inverters are often small, rectangular devices that plug directly into the cigarette lighter or DC outlet on the dashboard of a car or other vehicle. Larger inverters are used to convert solar or wind energy into AC power that can be used in a home. Called a grid-tie inverter, this device links into the utility grid to allow power to be delivered along the same wires that supply energy from an electric utility. It even allows any excess power produced to be fed back into the grid, where it can be sold to the utility company.

The solar power inverter is an electrical inverter that converts the direct current energy (DC) into alternating current (AC) for use either in a home or on an energy grid. In a solar energy system energy from the sun is gathered in photovoltaic cells (PV) that consist of semiconductor layers made of crystalline silicon or gallium arsenide. These layers are arranged in panels consisting of positive and negative layers. When the sun shines on the panels, light is absorbed and energy is transferred into the photovoltaic cell. Electrons in the light move from one layer to the other and produce an electric current. This current is direct current energy (DC). Depending on the type of system, it can either be stored for later use or sent directly to the inverter.

0.1 Need of study

In the coming future there will always be a need to save energy. If we talk about the electricity not only in India but in various countries there is a problem of full time electricity supply. To continue the work many people opt inverters. As all are not aware about the mechanism, input and output of inverters, therefore it is essential to know the output for future energy resources and its use. As the invention of inverter and its use in a domestic way is not so old. In a very less time inverter have approached our houses. In one hand previous research will have the advance shape and on another hand the new research will have the contents and base material from this study.

2. Fundamental elements of an inverter

2.1 Oscillator: An oscillator converts the input DC (Direct Current) from a lead acid battery into an oscillating current or a square wave which is fed to the secondary winding of a power transformer.

2.2 Transformer: Here the applied oscillating voltage is stepped up as per the ratio of the windings of the transformer and an AC much higher than the input DC source becomes available at the primary winding or the output of the inverter.

2.2 Charger: During power backups when the battery gets discharged to a considerable level, the charger section is used to charge the battery once the AC main is restored.

3. Output enhancement mechanism of electrical inverter (boost inverter)

Classical 3-phase inverters cannot produce AC voltage with the magnitude greater than DC input voltage. For an approach a DC-DC boost converter should be used between the DC voltage source and DC-AC converter. Power for the boost converter can come from any suitable DC sources, such as batteries, solar panels, rectifiers and DC generators. A process that changes one DC voltage to a different DC voltage is called DC to DC conversion. A boost converter is a DC to DC converter with an output voltage greater than the source voltage. A boost converter is sometimes called a step-up converter since it "steps up" the source voltage. Since power ($P = VI$) must be conserved, the output current is lower than the source current. Fig. 1 shows the basic schematic of a boost converter, switch is typically a MOSFET, IGBT, or BJT.

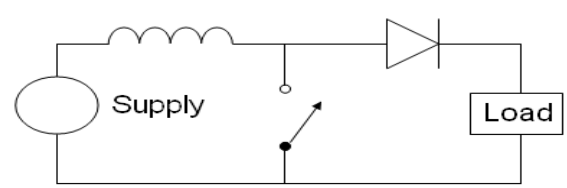


Fig. 1 The basic schematic of a boost converter.

3.1 Operating principle

The key principle that drives the boost converter is the tendency of an inductor to resist changes in current by creating and destroying a magnetic field. In a boost converter, the output voltage is always higher than the input voltage. When the switch is closed, current flows through the inductor in clockwise direction and the inductor stores some energy by generating a magnetic field. Polarity of the left side of the inductor is positive. When the switch is opened, current will be reduced as the impedance is higher. The magnetic field previously created will be destroyed to maintain the current flow towards the load. Thus the polarity will be reversed (means left side of inductor will be negative now). As a result two sources will be in series causing a higher voltage to charge the capacitor through the diode D.

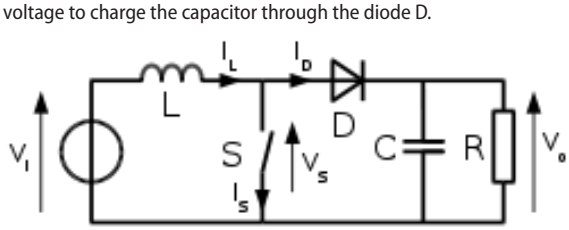


Fig. 2: Boost converter schematic

The basic principle of a boost converter

- In the On-state, the switch S is closed, resulting in an increase in the inductor current.
- In the Off-state, the switch is open and the only path offered to inductor current is through the flyback diode D, the capacitor C and the load R. This results in transferring the energy accumulated during the On-state into the capacitor.

4. Applications

Battery power systems often stack cells in series to achieve higher voltage. However, sufficient stacking of cells is not possible in many high voltage applications due to lack of space. Boost converters can increase the voltage and reduce the number of cells. Two battery-powered applications that use boost converters are hybrid electric vehicles (HEV) and lighting systems.

5. Conclusion

The main objective of this paper is to introduce a new type of mechanism for dc to ac inverter, referred to as boost inverter. The active switches are operated at a fixed frequency with the duty cycle around 50%, which allows the use of a simple gate drive. The operation has been described and discussed. The new inverter is applicable in UPS design, whenever an AC voltage larger than the DC link voltage is needed, with no need of a second power conversion stage. This arrangement is better for solar cell to home application.

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