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Design of Pure sine wave inverter

[1]Dr. C. S. Hiwarkar, [2] Miss. Kajal shrirao, [3] Mr. Pranay Bhongale,
[4] Miss. Prachi Selokar, [5] Miss. Amruta Gothwad

[1]Assistant Professor [2]Student, [3]Student, [4]Student, [5]Student

Electrical Department,
K.D.K. College of Engineering Nagpur, India

Email – [1]cshiwarkar@gmail.com [2]kajalshrirao2@gmail.com [3]pranaybhongale9931@gmail.com,
[4]prachiselokar2002@gmail.com [4]amruta.gothwad05@gmail.com

Abstract: *This paper outlines the design and construction process of a pure sine wave inverter, the inverter are often needed at places where it is not possible to get AC supply from the mains. an inverter circuit is used to convert the dc power to ac power can be two types true/pure sine wave inverter & modified inverters pure sine wave inverters are costly. While modified quasi- inverters are inexpensive. this inverter produces a sine wave and used to power electronics equipment. It is simple voltage driven circuit using IGBT as switch the device. Is build, & which convert the 12v dc signal to 220v ac with the help of step- up transformer. which is crucial component in various power systems requiring clean and stable AC power. The project begins with an overview of theoretical principles behind pure sine wave generation and the important of achieving of high- quality output waveforms for sensitive electronic equipment. The design methodology covers the selection of suitable components such as power transistors, capacitors. The construction phase layout of the circuit board, assembly of components, and controls the voltage regulation and overload protection.*

Key Words: *Inverters, step-up transformer, DC/AC, sine wave inverter, IGBT.*

1. INTRODUCTION:

This project focuses on dc to ac power inverter which aim to efficiently transform a dc power source to high voltage source like power that would be available at an electrical wall outlet. A pure sine wave inverter is a device that converts direct current (DC) electricity into alternating current (AC) electricity with a waveform that closely resembles a pure sine wave. This type of waveform is ideal for powering sensitive electronics and appliance, as it provides a smooth and consistent flow of electricity, mimicking the power supply from the utility grid. Pure sine wave inverters are commonly used in applications such as low voltage dc source such as batteries, solar panels, or fuel cell must be converted so the device run off of ac power, boats, homes where reliable and high- quality AC power is essential for the proper functioning of electronics devices.

2. LITERATURE REVIEW:

Sine wave inverter play a crucial role in converting direct current(DC)power from sources like batteries or renewable energy systems into alternating current (AC) power, mimicking the utility grid's waveform. In this literature review, we explore key research and publications related to the design and construction of sine wave inverter.

3. METHOD:

The method used here, described for those who may benefits from it. Initialize all ports and peripherals [ADC, timer as compare module for this is quasi-sine wave inverter that we made since it was more demanding than the sine at the time. We have project with quasi-sine wave as well with a microcontroller the design here uses a IRFP55 on each leg for 100w. We can use other MOSFETs as well There are two resistances for driving the MOSFETs, on the control board. Microcontroller requires 5v to operate, hence a regulator IC 7805 is used with input filter capacitor of 1000uf and output storage capacitor 470uf. Output volt is adjusted to achieve 230v 220v as required. With the help of variable resistance (POT) connected on AD0 pin of microcontroller pic. The transformer we have is 9-0-9 primary, does not need to be accurate, since you can adjust the output voltage using the pot. What I meant is, say you wanted a 12-0-12 transformer,

but you got some error, but you got some error, then you can adjust the present pot to set the output at 230v no Separate winding, feedback is done on board using the diode/cap/resistor and micro IGBT can be added for a nice design, but we omitted it, as it is costlier than MOSFET, availability of MOSFET's easy also we can replace in case of burnt. The transformer is rated at 500w power and is a standard transformer used for 500w inverters over here. The primary voltage is 12-0-12, secondary voltage is 0-240, and this inverter has short circuit protection. It uses the fact that during short voltage protection is not provided as not provided as it's connected to the battery24/7.

Square wave inverter

Dc to Ac conversion is commonly done through use of MOSFET inverter circuits, which can switch the voltage across the load the simplest variant of the inversion is the production of sine wave for a square wave, the load voltage must be switch merely from high to low, without the need for an intermediate step in order to deliver the same power as the sine wave to be approximated, the amplitude of the square wave must be the sine wave's RMS value, this way. The average voltage s, and therefore the power delivered, the same power as the sine wave to be approximated, the amplitude of the square wave must be the sine wave 's RMS vale. this way the average voltages and therefore the power delivered, will be at the same for the two the two waveform Square wave inverters are very rarely used in practice, as many devices which utilize timing circuit that relayon something close to the sine wave from the power company cannot operate with such a rough approximation.

SINE WAVE INVERTER

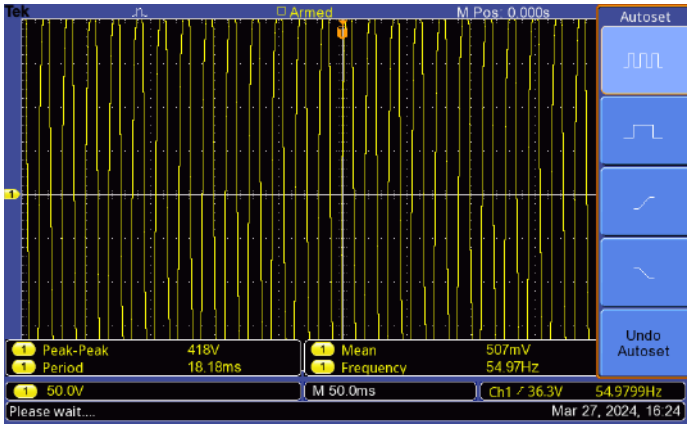
The Most Common technique of digital pure sine wave generation Is pulse-width modulation (PWM) the PWM techniques inviolés génération of the a digital aviforme for the which the duty-cycle Is module such that the average voltage of the aviforme, for which the duty- cycle Is modulated such that the average voltage of the waveforms corresponds to a pure sine wave. The simple way of producing the PWM signal is through comparison of a Löw-power reference sine wave with a triangle wave. Using thèse two signals as input to a comparator the output Will bé a 2- level PWM signal. This PWM signal scan then bé used to control switches connected to a high- voltage buds, which Will replicate this signals at the approximate voltage. Put through an LC filter. This PMW signal Will clean up into a close approximation of a sine wave.

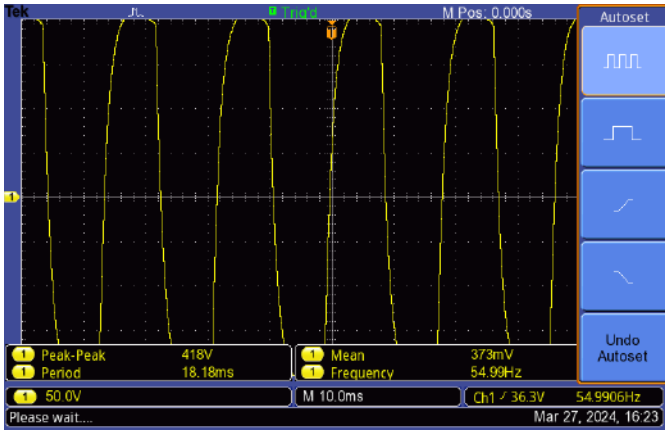
WORKING:

Check the battery level
-If battery level < 13.5v (this voltage is set using a pot, so can be easily adjusted), charge at the set current (set with a pot).
-If battery level > 13.5v, stop charging
-While battery > 13.2v, stop charging
-If battery voltage drops instantly start charging again
-initialize Timer and start PWM
-Check battery voltage, stop PWM and indicate on LED when battery falls below 10.8v (this is also set with a pot), response time is fast so a short circuit that produces an instant voltage drop is detected
-Check load level, check against present level (set with pot) and if too high, shut down and indicate
-Check output voltage, adjust as required
This is a quasi-sine wave inverter that we made since it was more demanding than the sine at the time. we havea project with quasi-sine wave as well with a PIC microcontroller
The design here uses IGBT x 2 on each leg for 100W. We can use other IGBTs as well. There are 2 transistors for driving the IGBTs, on the control board - 2xc547.
For up to the 5V, we need to change the 7805 with an auxiliary supply, that's the only change. Output volt is adjusted to achieve 230V or 220V as required that is for feedback voltage setting or output voltage setting when running in inverter mode. Battery max is for battery high cut voltage, to cut off charging when battery reaches a specific voltage. I set mine at around 13.5v.
Charging current is for setting the current at which battery is to be charged. In our 1Amp is set to charge the battery. Low battery is for setting battery low cut voltage. in our project will be for 10.5v
The transformer we have is 9-0-9 primary, doesn't need to be accurate, since you can adjust the output voltage using the pot. What I meant is, say you wanted a 9-0-9 transformer, but you got some error, then you can just adjust the present/pot to set output at 220v. No separate winding, feedback is done on board using diode/cap/resistor and micro. Charging is done using the same IGBT board, no special capacitor or inductor, just a snubber on the board. Transformer primary is not strict.

IGBT can be added for a nice design, but I omitted it as it was more demanding to have the IGBT board separate, in case the IGBTs burnt. Haven't had a situation till now, but it can easily be made into one nice PCB.
The transformer is rated at 500W power and is a standard transformer used for 500W inverters over here. The primary voltage is 9-0-9, secondary voltage is 0-240.This inverter has short circuit protection. It uses the fact that during a short circuit, DC bus voltage significantly decreases. The microcontroller senses that and indicates short circuit. Reverse voltage protection isn't provided as it's connected to the battery 24/7.

4. RESULT:





The result of successfully designing and constructing a sine wave inverter is a reliable and efficient power source capable of converting DC electricity from a battery or other DC source into AC power with a clean source into AC power with a clean sinusoidal waveform. This output is essential for powering sensitive electronic devices like computers, appliances, and medical equipment, as it closely resembles the electricity provided by utility grids.

5. CONCLUSION:

In conclusion, a 500watt sine wave inverter offers a reliable and efficient solution for converting DC electricity into clean and stable AC power. The ranging from off-grid solar systems to portable power solutions benefits from its ability to power sensitive electronic device with minimal harmonic distortion. The significance of a sine wave inverter lies in its capacity to produce a smooth and continuous waveform like the power supplied by utility grids. This ensures compatibility with a wide range of appliance and equipment, making it suitable for both residential and commercial use. Additionally, the compact and lightweight design of many 500watt sine wave inverter enhances their portability, enabling them to be deployed in diverse setting such as camping trips, outdoor events, and emergency backup power setup. With built-in protection features and high efficiency levels, this inverter offer reliable performance while safeguarding both the inverter and connected device from potential damage. In summary, the 500-watt sine wave inverter represent a versatile and stable AC power for various application where quality and reliability are paramount**.**

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