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PWM BASED SINE WAVE INVERTER FOR LINEAR LOAD

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Abstract: 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 of two types True/pure sine wave inverters and quasi or modified inverters these true/pure sine wave inverters are costly while modified quasi-inverters are inexpensive. this modified inverter produced a sine wave and these are used to power delicate electronics equipment. here, a simple voltage driven inverter circuit using power IGBT as switching devices is build, which converts 12v dc signal to signal phase 220volt ac with the help of step-up transformer. The basic idea behind every inverter circuit is to produced oscillation using the given dc and apply this oscillation across the primary of the transformer by amplifying the current. This primary voltage is then stepped up to higher voltage higher voltage is then stepped up to higher voltage depending upon the number of turns in primary and secondary coils.

Index Terms - **Power Inverter; Dc**/AC, sine **wave; Oscillator; Transformer.**

I. INTRODUCTION

This project focuses on dc to ac power inverters which aim to efficiently transform a dc power source to high voltage a source like power that would be available at an electrical wall outlet. Inverters are used for many applications, as in situation where low voltage dc sources such as batteries, solar panels or fuel cells must be converted so that devices can run off of ac power One example of such a situation would be converting electrical power from a car battery to run a laptop, tv or cell phone. The method in which the low voltage dc power is inverted, is completed in two steps. The first being the conversion of the low voltage dc power to a high voltage dc source, and the second step being the conversion of the high dc source to an AC waveform using pulse width modulation. another method to complete the desired outcome would be first convert the low voltage dc Power to ac & then use a transformer to boost the voltage to 220v .this project focused on the first method described and specifically transformation of high voltage dc source into an ac output of the different dc - inverters on the market today there are essentially two different forms of ac output generated modified sine wave , can be seen as more of a square wave than the sine wave; it passes the high dc voltage for specified amount of the time so that the average power and rms voltage are the same as if it were wave. These types of inverters are much cheaper than pure sine wave inverters and therefore are attractive alternatives.

II. LITERATURE SURVEY

In the book of -Giwa Abdul afar Babatunde -A 500 watt PWM dc /ac 220 v power inverter which is design to convert direct current dc to alternating current ac with the use of a transformer ,switching and control circuit was designed and construct using SG3524 which is and integrated switching regulated that has all essential circuit tree required for making a switching regulator in sill ended or push-pull mode .the built-in circuit tress inside the SG3524 Include pulse width modulator , oscillator, voltage , references error amplifier ,over load protection circuit, output driver etc. which procced the DC signal to Ac signal & later sent the current signal into a driver transistor BC558 acting as class B voltage amplifier, the resulting signal was further amplified using for MOSFET transistor mounted on a heat sink. the resulting alternating voltage to which a 12 v Dc is superimposed was fed into the middle of the primary coil of 500-watt transformer windings producing alternating current ac in the secondary wind 220-volt Ac.

III. WORKING

Described bed the circuit as: - single microcontroller /controller (pic), no op-amps, only chips are the Micro, PWM generator, transistors, and regulators (7805), low-battery protection,16*2 lcd display. Relay between switchover to run the load. The method used here, described for those who may benefits from it :Initialize all ports and peripherals [ADC, Timers, Compare Modules]Initialize interrupts for Timer0 and compare module for ,For SPWM ,use timer 1 and 16-bit phase and frequency correct PWM mode so the PWM runs completely on the hardware level without need for interaction to keep it running check the battery level ,if the battery level is <13.5v(this voltage is set using a pot ,so can be easily adjusted),charge at the set current (set with a pot)If the 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 ,shunt down and indicate ,check output voltage, adjust as required ,this is a quasi-sine wave inverter that we made since it was more demanding that the sine at the time .we have a project with quasi-sine wave as well with a pic microcontroller ,the design here uses IRFP150x2 on each leg for 100 w .we can use other MOSFETs as well there are 2 transistor for driving the MOSFETs, on the control board -2xc547,for upto12 v we need to change the 7805 with an auxiliary supply ,that's the only change. If battery increases while charging then there is battery full charged indicator. output volt is adjusted to achieved 230v as per requirement that is for feedback voltage. That for feedback voltage setting or output voltage setting when running in inverter mode. Battery max is for battery high cut voltage to cut of charging when battery reaches specific voltage. I set mine at around 13.5vCharging current is for setting a 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 for 10.5 volt The transformer we have is 9-0-9 primary, does not need 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 preset/pot to set output at 230v. No separate winding, feedback is done on board using diode/capacitor/resistor micro charging is done using the same IGBT board no special capacitor or inductor, just 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 IGBT s burnt. Haven't had a situation till now, but it can easily be made into one nice PCB. The transformer is rated at 100watt Power and transformer used for 100w inverter over here. The primary voltage is 9-0-9, secondary voltage is 0-240. This inverter has short circuit protection it used that fact a short circuit DC bus voltages significantly deceases the microcontroller senses that and indicate short circuit. Reverse voltage protection isn't connected to the battery 24/7.

IV. PROPOSED Methodology

The method used here, described for those who may benefits from it: initialize all ports and peripherals [ADC, Timers 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 a project with quasi-sine wave inverter that we made since it was demanding than the sine at the time. we have a 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 or 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 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, this inverter has short circuit protection. It uses the fact that during a short voltage protection is not provided as it's connected to the battery 24/7.

IV.1. Square wave inverter

Dc to ac conversion is most commonly done through use of MOSFET inverter circuits, which can switch the voltage across the load , providing a digital approximation of the desired ac signal .the simplest variant of this inversion is the product ion of sine wave .for a square wave, the load voltage must be switch d merely from high to low ,without the need for an intermediate step (i,e.ov).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 value ,this way the average voltages ,and therefore the power delivered, will be at the same for the two waveforms. Square wave inverters are very rarely used in practice, as many devices which utilize timing circuits that rely on something close to the sine wave from the power company cannot operate with such a rough approximation.

VI.2. SINE WAVE INVERTER

The most common and popular technique of digital pure-sine wave generation is pulse-width-modulation (PWM)the PWM technics involves generation of a digital waveform, for which the duty-cycle is modulated such that the average voltage of the waveform, for which the duty-cycle is modulated such that the average voltage of the waveforms corresponds to a pure sine wave .the simplest way of producing the PMW signal is through comparison of a low-power reference sine wave with a triangle wave. Using these two signals as input to a comparator the output will be a 2-level PWM signal. this PWM Signal can then be used to control switches connected to a high - voltage bus, which will replicate this signal at the approximate voltage. Put through an LC filter, this PMW signal will clean up into a close approximation of a sine wave.

V. CONCLUSION

In conclusion, a 500watt sine wave inverter offers a reliable and efficient solution for converting DC electricity into clean and stable AC power. Through this technology, various applications ranging from off-grid solar systems to portable power solutions benefit 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 appliances 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, these inverters 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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