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Survey on Pure Sine Wave Inverter Using Sinewave Generator Technique

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ABSTRACT: This project aims to developing the control circuit for a single phase inverter which produces a pure sine wave with an output voltage that has the same magnitude and frequency as a given by utility. A microcontroller, based on an advanced technology to generate a sine wave with fewer harmonics, less cost and a simpler design. The technique used sine wave generator is to generate sine wave for triggering of inverter. The designed inverter is tested on various AC loads and is essentially focused upon low power electronic applications such as a lamp, a fan and chargers etc. The proposed model of the inverter can improve the output wave forms of the inverter.

KEYWORDS: Sine wave, Inverter, H- Bridge, Sine wave generator.

I.INTRODUCTION

Now a days the demand for electricity is increasing day by day. One of the best way to satisfy the demand by using of renewable sources of energy. The renewable energy can converted into electrical energy for the house hold applications. The most available form of renewable energy is the solar energy, hence it can be used for all type of domestic appliances, for that the solar inverters most commonly used in this system. The solar inverter should be able to operate the home appliances smoothly. Most of the Uninterrupted Power (UPS) available in market are designed as square wave and quasi wave inverters, which is not suitable for most of the electrical appliances. The outputs of these types of inverters are with more harmonics and are less efficient. If sinusoidal waveform is not provided to the appliances the life time of the appliances will reduce day by day. The generated sinusoidal output waveform from the inverter is to overcome this type of disadvantages. The sinusoidal output waveform can be obtained by implementation of sine wave generator technique to the inverter circuit. The sine wave inverter can be implemented by continuous switching in a particular sequence of the inverter. The switching technique is characterized by constant amplitude pulse width a different duty cycle of each period. The application of this type of inverter can be for the house hold appliances.

II. SINE WAVE GENERATOR

In various design and test situations, a sine wave signal with an arbitrary frequency may be needed. The following design, and accompanying Excel spreadsheet implement a sine wave generator that can be quickly assembled with a dual op amp and small number of resistors and capacitors. Figure shows the schematic for the quick sine wave generator.

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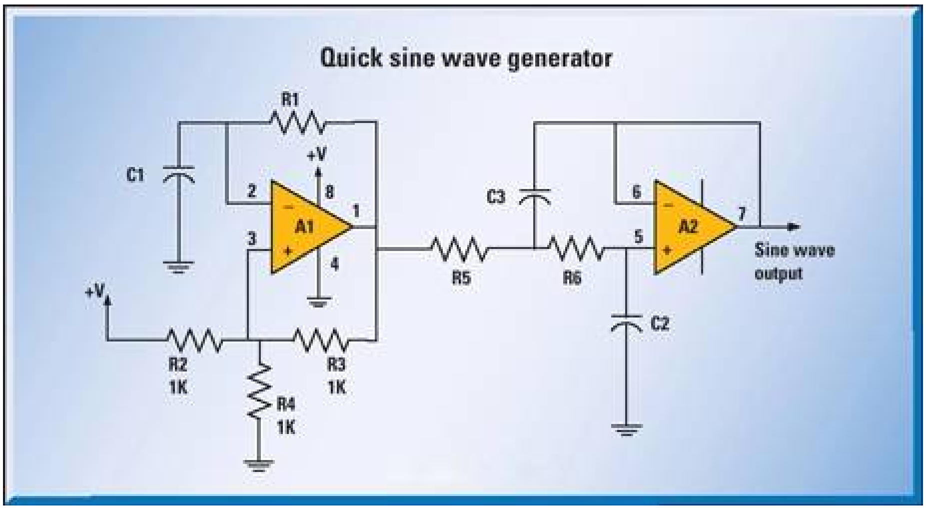

This circuit generates a sine wave by first generating a square wave, at the required frequency, with amplifier A1 that is configured as an astable oscillator with the frequency determined by R1 and C1. The two-pole low pass filter, using A2, filters the square wave output from A1. The filter is a unity gain Sallen-Keys filter with its cut off frequency equal to the square wave frequency from A1. The square wave is made up of the fundamental frequency and the odd harmonics of the fundamental frequency. The filter removes most of the harmonic frequencies and the fundamental frequency remains at the output of A2. The fundamental frequency component of a square wave is about 1.27 times the peak amplitude of the square wave and the amplitude of the sine wave output will be approximately 87 percent of the peak of the square wave. The peak of the square wave will depend on the amplifier's supply voltage and the output swing specification of the amplifier. Additionally, the peak of the square and the sine wave will track changes in the amplifier's supply voltage. In this design, the frequency is specified along with the value of C1 and based on these values, the values of R1, C2, C3, R4, and R5 are calculated. The values of R2, R3 and R4 are 1K Ohms and should be matched in value to help minimize errors in the actual frequency of operation compared to the calculated frequency of operation. The equations for the component selection follow. The frequency, F, is the required sine wave frequency. The value for C1 is selected arbitrarily, with a value of 0.001 μfd being a good initial value for 1 MHz.

III.H BRIDGE INVERTER

The term H bridge is derived from the typical graphical representation of such a circuit. An H bridge is built with four switches (solid-state or mechanical). When the switches S1 and S4 (according to the first figure) are closed (and S2 and S3 are open) a positive voltage will be applied across the motor. By opening S1 and S4 switches and closing S2 and S3 switches, this voltage is reversed, allowing reverse operation of the motor.

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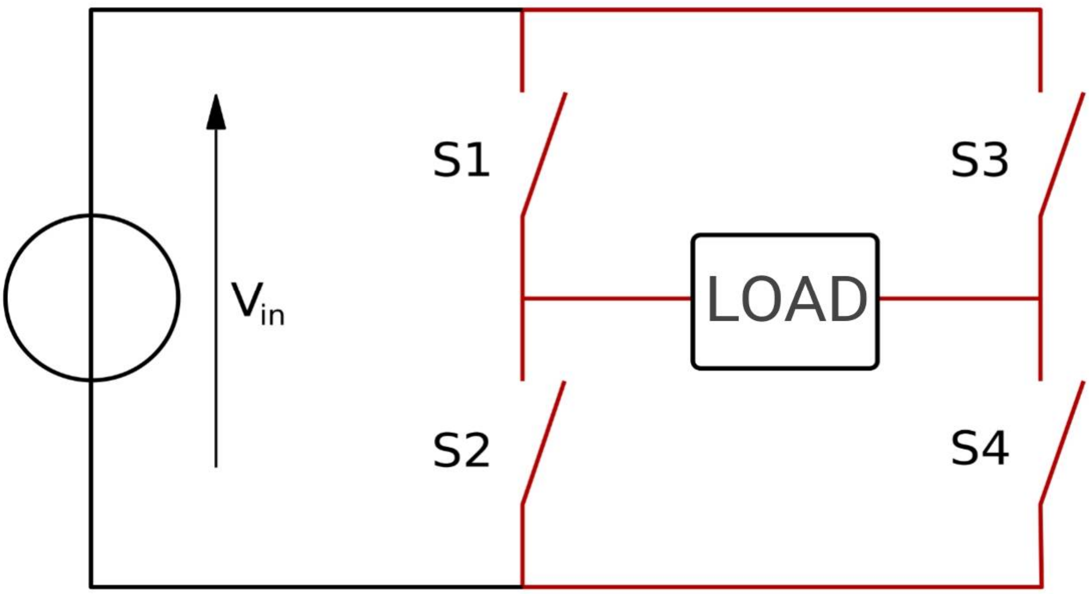

Using the nomenclature above, the switches S1 and S2 should never be closed at the same time, as this would cause a short circuit on the input voltage source. The same applies to the switches S3 and S4. This condition is known as shoot-through.

The H-bridge arrangement is generally used to reverse the polarity/direction of the motor, but can also be used to 'brake' the motor, where the motor comes to a sudden stop, as the motor's terminals are shorted, or to let the motor 'free run' to a stop, as the motor is effectively disconnected from the circuit.

IV.SINE WAVE INVERTER

An H-Bridge converter is a switching configuration composed of four switches in an arrangement that resembles an H. By controlling different switches in the bridge, a positive, negative or zero-potential voltage can be placed across a load. When this load is a motor, these states correspond to forward, reverse, and off. The use of an H-Bridge configuration with N-Channel MOSFET As shown in Figure the H-Bridge circuit consists of four switches corresponding to high side left, high side right, low side left, and low side right. There are four possible switch positions that can be used to obtain voltages across the load. These positions are outlined in Table 1. Note that all other possibilities are omitted, as they would short circuit power to ground, potentially causing damage to the device or rapidly depleting the power supply.

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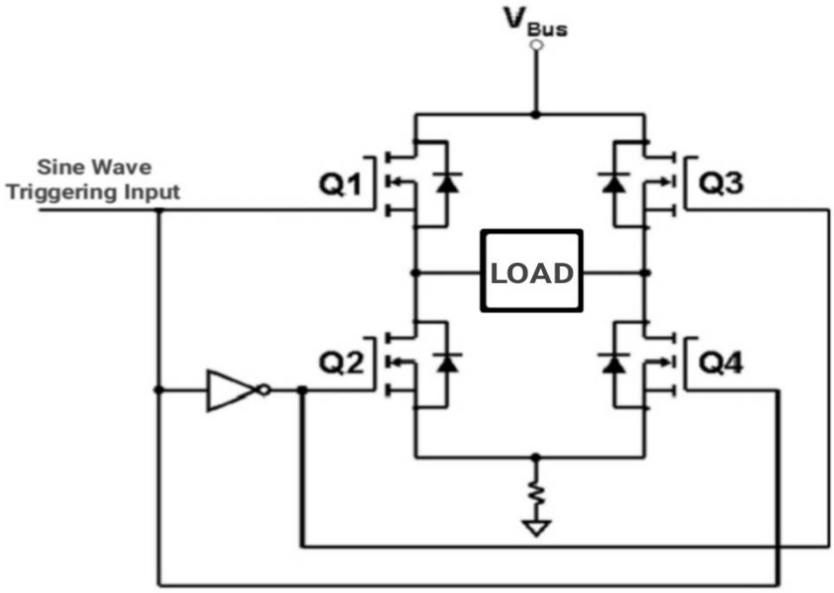

H-Bridge Inverter Circuit

The switches used to implement an H-Bridge can be mechanical or built from solid state transistors. Selection of the proper switches varies greatly. The use of P-Channelmosfets on the high side and N- Channel mosfets on the low side is easier, but using all N-Channelmosfets and a FET driver, lower "on" resistance can be obtained resulting in reduced power loss. The use of all N-Channelmosfets requires a driver, since in order to turn on a high-sideN-Channel MOSFET, there must be a voltage higher than the switching voltage (in the case of a power inverter, 170V). This difficulty is often overcome by driver circuits capable of charging an external capacitor to createadditional potential. MOSFET drivers and discussion of how they achieve this higher potential are discussed in the following section.

V.CONCLUSION

The goals for this project were to produce a pure sine wave DC-AC inverter that would output at 50 Hz, 220 volts RMS, would be cheap to manufacture, and fairly efficient in the method in which it produces it. Taking a look at these goals and the end result it can be said that they were met, This cost however, is when buying parts one at a time, if manufactured this price tag would drop greatly due to the quantities of parts that would be bought.

The second goal, to produce a 220 volt RMS sine wave with the capability of providing 250 watts of power was not actually tested, but the team is confident in its ability to produce this waveform. Using parts in the driver portion of the circuit that are rated for at least twice the operating parameters, 220 volts and 2 amps, the team can be assured that these devices will work with the same functionality as they do at 12 volts. At 12 volts powering, the H-Bridge output is a clean 50 Hz sine wave that can easily be controlled in size by the size of the sine reference in the control circuit. It is in this capability that the option of a closed loop control circuit could be implemented.

In looking at how efficient this project is, there is no hard data that can be referred to as not enough time was available to collect it. In looking at the components selected and the simulations created before the actual construction of the inverter, everything was built in mind for the purpose of efficiency and keeping power losses to a minimum.

This project is a stepping stone to a cheaper and efficient pure sine wave inverter, by using the data collected in this report as well as the schematics and recommendations the product produced here can be improved upon. Simple additions such as circuit protection and a closed loop control system could greatly improve the performance of this project. The project, in its present condition, does work in the manner the team wished and has met every goal set at the commencement of this venture.

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