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SOLAR ENERGY BASED SINE WAVE INVERTER

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Abstract— *In this paper, we study the system performance Subject of this work is a presentation of conducted review of Energy crisis are of special attention now-a-days. A need for reasonable power rating inverter is required to smoothly operate electrical and electronic appliances. Most of the commercially available uninterruptible power supply (UPS) are actually square wave inverters or quasi sine wave inverters. Lights and fans can only be switched with the help of them and other electronic devices cannot be plugged into them as they damage them. Available sine wave inverters are very expensive and by examining the output wave, it is observed that it is not of good quality. Quality of output waveform of an inverter is determined by the harmonic contents present in it. An ideal inverter should only have a fundamental harmonic component at the designed frequency.. The inverter output is regulated from 16-volt rms to 230-volt rms . The design is mathematically model which will be simulated using software Matlab, Proteus and the results will be verified.*

Keywords— HVDC , UPS, IIR,PWM

1. INTRODUCTION

Project focuses on DC to AC power inverters, which aim to efficiently transform a DC power source to a high voltage AC source, similar to power that would be available at an electrical wall outlet. Inverters are used for many applications, as in situations 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 to first convert the low voltage DC power to AC A need for reasonable power rating inverter is required to smoothly operate electrical and electronic appliances. Most of the commercially available UPS are actually square wave inverters or quasi sine wave inverters. Lights and fans can only be switched with the help of them and other electronic devices cannot be plugged into them as they damage them. Available sine wave inverters are very expensive and by examining the output wave, it is observed that it is not of good quality of output waveform of an inverter is determined by the harmonic contents present in it. An ideal inverter should only have a fundamental harmonic component at the designed frequency. Square wave contains odd harmonics from which fundamental harmonic component can be extracted by applying higher order filter. Higher order filters in terms of inductors and capacitors are physically unrealizable, its mathematical analysis becomes complex and gain of the system decreases drastically.There are different topologies for implementing sine wave inverter. Sine wave inverter is widely used in many commercial and industrial applications including uninterruptable power supplies, induction heating, variable frequency drives, electrical vehicle drives and HVDC links.A control circuit based advanced technique of generating sine wave with minimized harmonics is implemented in this project.

2. LITERATURE SURVEY

As early as 1886, German physicist Heinrich Hertz showed that solar energy inverter. In 1895, Alexander Popov, a physics instructor at the Imperial Russian Navy school in Kronstadt, developed an apparatus using a coherer tube for detecting distant lightning strikes.The German inventor Christian Hülsmeyer was the first to use radio waves to detect "the presence of distant metallic objects". In 1904 he demonstrated the feasibility of detecting a ship in dense fog, but not its distance from the transmitter. He got a British patent on September 23, 1904 for a full system, that he called a telemobiloscope.In 1922 A. Hoyt Taylor and Leo C. Young, researchers working with the U.S. Navy, had a transmitter and a receiver on opposite sides of the Potomac River and discovered that a ship passing through the beam path caused the received signal to fade in and out. Taylor submitted a report, suggesting that this might be used to detect the presence of ships in low visibility, but the Navy did not immediately continue the work. Eight years later, In Kenya power outage have become more frequent owing to the lack of incentives to invest in aged national grid, transmission and distribution infrastructures, as well as the fact that energy from decentralized, “volatile” renewable sources is not well aligned to work on electricity grids. With an example of April 15th 2012 fault at the Kenya Power national control center and July 2011 power rationing regime due to East Africa's drought these brings a challenge to power facilities like medical centers, households and businesses. Frequent power outages are inconvenient, expensive and difficult to mitigate without very expensive backup power systems. Some of solution to this problem is an auxiliary AC power generator and solar panels but the cost of fossil fuels continues to increase rapidly thus it will not be cost effective in the future while solar power has some aesthetic, economic and technical drawbacks. A more effective and reliable alternative is battery power back-up system

3. METHODOLOGY

A. Sine Wave Generator

The first step to creating an accurate pulse width modulation signal using analog circuitry is to construct an accurate representation of the signal you wish to duplicate. In the case of a pure sine wave inverter the team wanted to construct a 50 Hz sine wave output. Therefore an oscillator was needed to produce a stable 50 Hz sine wave that had little distortion so that the output could be as accurate as possible. A "Bubba" oscillator was chosen as the means to produce this signal because of its ability to produce a stable sine wave that contains very little distortion shown fig 1.

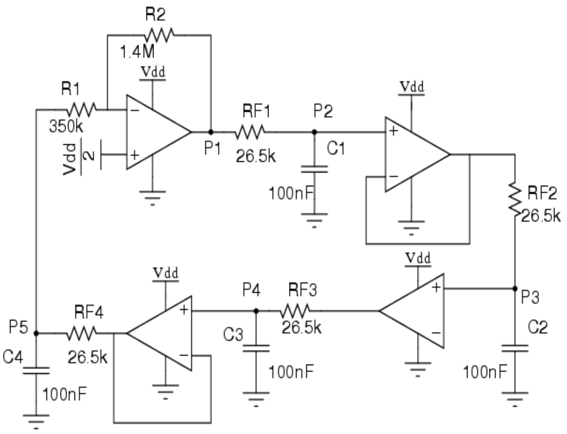

Fig.1 Bubba Oscillator Circuit

B. Carrier Wave Generator

Generating a sine wave at 50Hz requires both the reference sine wave and a carrier wave at the switching speed of the power supply. Carrier waves can be either sawtooth or triangular signals in this case, a triangular wave will be used. This wave will be at 50KHz as determined in optimal power loss simulations. The generation of the triangular carrier wave will be done with analog components. The circuit for the construction of the triangle wave generator consists of a square wave generator and integrator.

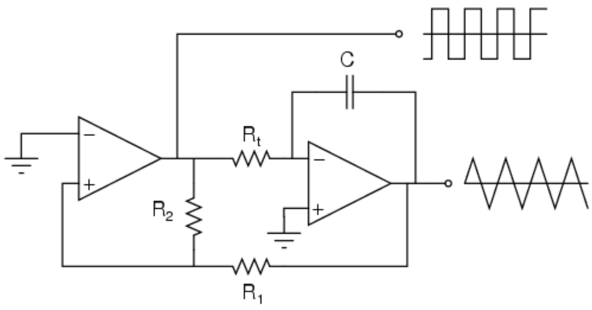

Fig.2 Triangle Wave Generator

The above circuit will oscillate at a frequency of 1/4RtC, and the amplitude can be controlled by the amplitude of R1 and R2. The frequencies that can be generated by this circuit depend greatly on the slew rate of the operational amplifiers. Using a TL084, output waves with frequencies of up to 40KHz can be generated. Speeds of 50KHz require an opamp with a faster slew rate. Using the TL084 op amp, with Rt=1K, R1=R2=10K, and C=.1uF, this circuit generates square and triangle waves oscillating at 5Khz. The slew rate of this operational amplifier is 12V/uS and will allow switching speeds up to 43KHz. With an op amp with a higher slew rate, the capacitor will be replaced with a .01uF capacitor, increasing the frequencies to 50KHz.

4. SYSTEM ARCHITECTURE

1] Solar Power: Solar AC power system is consisted of solar panels, charger controllers, inverters and rechargeable batteries, while solar DC power system is not included inverters. The inverter is a power conversion devices, which can be divided into self-excited oscillation inverter and external excited oscillation inverter.
2] Filter: In order to optimize the efficiency, a switching frequency must be chosen which is low enough to keep the switches in line, but high enough to make sure the filter inductor is not unnecessarily large. Many engineering tools will assist with this decision, but here we chose to utilize MatLab..
3] Battery: Power inverters are devices which can convert electrical energy of DC form into that of AC. They come in all shapes and sizes, from low power functions such as powering a car radio to that of backing up a building in case of power outage
4] Inverter: An inverter does the opposite job and it's quite easy to understand the essence of how itworks. Suppose you have a battery in a flashlight and the switch is closed so DC flows around the circuit, always in the same direction, like a race car around a track. Now what if you take the battery out and turn it around.
5] Step Up transformer: A transformer is an electrical device that transfers energy between two circuits through electromagnetic induction. A transformer may be used as a safe and efficient voltage converter to change the AC voltage at its input to a higher or lower voltage at its output.

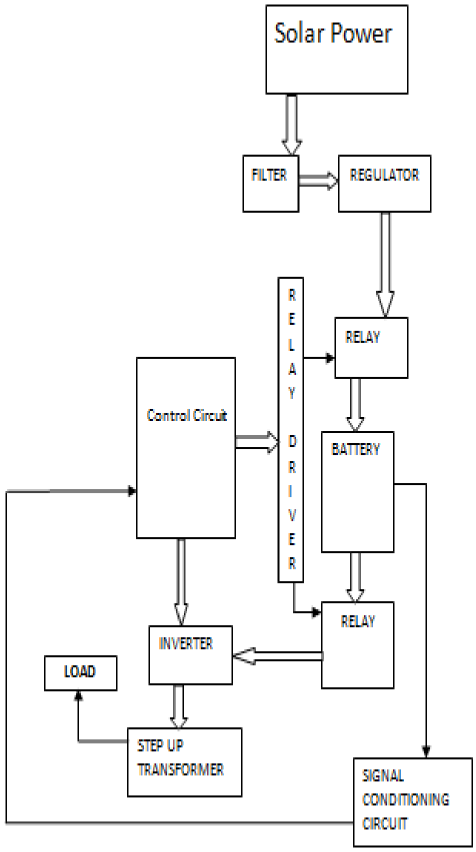

Fig.3 System Architecture

5. EXPERIMENTAL RESULTS

Through careful handling of control signals in the circuit, the MOSFETs in the Hbridge Were correctly switched, resulting in a 50 Hz sine wave output, as shown in Figure 4

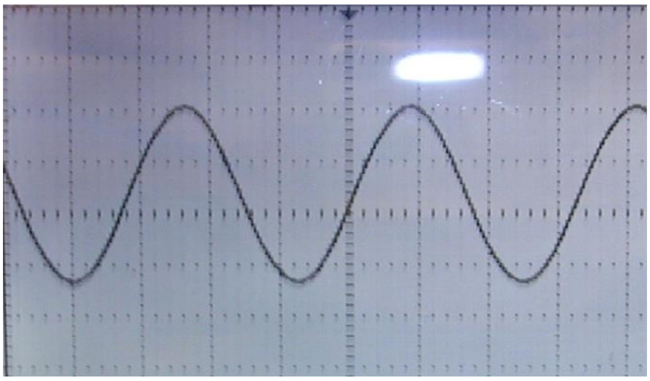

Fig.4 output result system

The output shown above was for an input voltage of 12V load after the filter. The amplitude of the output wave was only 14V pk discrepancy easily explained by the low ratio of sine wave to triangle wave control signals.

6. CONCLUSIONS

Through this paper we aim to The basic goal of this project, which is designing and implementing a working DC-AC sine wave inverter that could efficiently provide 50V of power using single PWM. the journey of facing and overcoming difficulties would train us for the future higher end projects.

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