A Novel Methodology of Two Phase to Three Phase Supply in Induction Motor for Agriculture

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***Abstract*— This paper proposes a two phase to three phase conversion system for a three phase load applications. This is mainly used for the induction motor, while two phase supply is given. While running the induction motor in two phase supply, the current imbalance will be occur in the motor windings, because of the presence of capacitor. This system allows the load current shared between the windings are equal. This feature also allows the switching frequency to be increased.**

To overcome this problem, a pulse width modulation (PWM) technique using a single or double carries PWM implementation is presented. Proposed technologies permit to improve the harmonic distraction. In addition, it can reduce converter power losses. Finally, simulation and experimental results are presented for validation purpose.

***Key Words* — Power Electronics Converters, Pulse Width Modulation Converters.**

I. INTRODUCTION

Over the years, two phase to three-phase conversion systems were made possible by the connection of passive element capacitors and reactors with autotransformer converters. Such kind of system presents well known disadvantages and limitations. So, to overcome from this problem, the newly pulse width modulation converters and power electronics devices were used mainly thyristors like SCRs, MOSFETs, GTOs etc. The project is about 'two phase to three phase conversion system using pulse width modulation converters. In rural areas, in order to operate machine tools and rolling mills as well as in low power industrial application for robotics, where a three phase utility may not be available, high-performance converters are typically used to run the three-phase motor drives. Low losses and cost effectiveness are the very important properties for these converters various two-phase to three-phase converters have been proposed with at least 6 switches. An alternative for the reduction of losses in these converters is that the number of power switches is reduced. Many components-minimized structures are proposed in literatures[1], Pulse Width Modulated (PWM) inverter systems are used in a wide variety of applications as a front-end power conditioning unit in electric drives, uninterruptible power supplies, high voltage DC transmission, Active power filters, reactive power compensators in power systems, Electric vehicles, Alternate energy systems and Industrial processes. The inverters realize dc-to-ac power conversion and in the most commonly used voltage source inverter configuration. The dc-input voltage can be obtained from a diode rectifier or from another dc source such as a battery. A typical voltage source PWM inverter system consists of rectifier, DC-link, PWM inverter along with associated control circuit and the load. Most modern voltage source inverters are controlled using a wide variety of pulse width modulation schemes, to obtain output ac voltages of the desired magnitude and frequency shaped as closely as possible to a since wave. Analysis of PWM inverter system is required to determine the input-output characteristics for an application specific design, which is used in the development and implementation of the appropriate control algorithm.In addition, several modulation and control strategies have been developed or adopted for multilevel inverters including the following: multilevel sinusoidal pulse width modulation (PWM), multilevel selective harmonic elimination, and space-vector modulation.

II. OBJECTIVE

The main objective of this project is to equalize the load current flows through the windings. While using the two phase supply the variation of load current will be occurs. This will makes damage to the winding of the motor.

III. PROJECT DESCRIPTION

The following are the components used in this project.

A. Bridge Rectifier

A diode bridge is an arrangement of four (or more) diodes in a bridge circuit configuration that provides the same polarity of output for either polarity of input. When used in its most common application, for conversion of an alternating-current (ac) input into a direct-current (dc) output, it is known as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two wire ac input, resulting in lower cost and weight as compared to a rectifier with a 3-wire input from a transformer with a centertapped secondary winding. The essential feature of a diode bridge is that the polarity of the output is the same regardless of the polarity at the input. The diode bridge circuit was invented by polish electro technician karol pollak and patented on 14 jan 1896 under the number drp 96564. In 1897, the german physicist leo graetz independently invented and published a similar circuit.

ISSN: 2278-0181

Fig. 1 Bridge Rectifier

B. PWM INVERTER

PWM or Pulse width Modulation is used to keep the output voltage of the inverter at the rated voltage (110V AC / 220V AC) irrespective of the output load. In a conventional inverter the output voltage changes according to the changes in the load. To nullify effect caused by the changing loads, the PWM inverter correct the output voltage according to the value of the load connected at the output. This is accomplished by changing the width of the switching frequency generated by the oscillator section. The AC voltage at the output depend on the width of the switching pulse. The process is achieved by feed backing a part of the inverter output to the PWM controller section (PWM controller IC).Based on this feedback voltage the PWM controller will make necessary corrections in the pulse width of the switching pulse generated at oscillator section. This change in the pulse width of the switching pulse will cancel the changes in the output voltage and the inverter output will stay constant irrespective of the load variations.

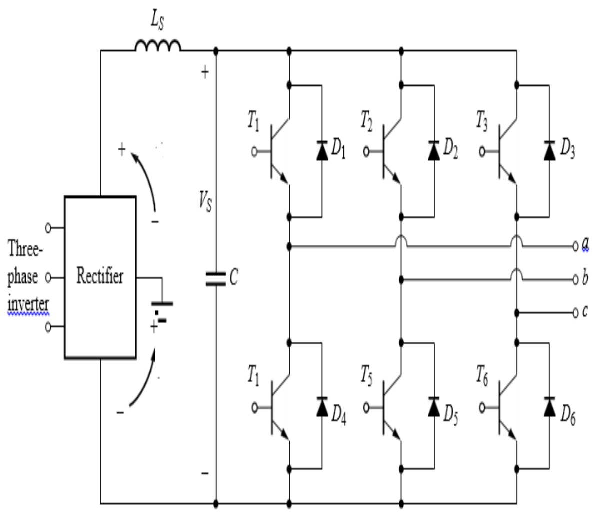


Fig. 2 PWM INVERTER

A comparator is a device that compares the input voltage $v_{in}(t)$ to a reference signal and turns transistors on or off depending on the results of the test. Comparator A compares $v_{in}(t)$ to the reference voltage $v_x(t)$ and controls IGBTs T_1 and T_2 based on the results of the comparison. Comparator B compares $v_{in}(t)$ to the reference voltage $v_y(t)$ and controls IGBTs T_3 and T_4 based on the results of the comparison. If $v_{in}(t)$ is greater than $v_x(t)$ at any given time t, then comparator A will turn on T_1 and turn off T_2. Otherwise, it will turn off T_1 and turn on T_2. Similarly, if $v_{in}(t)$ is greater than $v_y(t)$ at any given time t, then comparator B will turn off T_3 and turn on T_4. Otherwise, it will turn on T_3 and turn off T_4. To understand the overall operation of this PWM inverter circuit, see what hap- pens when different control voltages are applied to it. First, assume that the control volt- age is 0 V. Then voltages $v_u(t)$ and $v_v(t)$ are identical, and the load voltage out of the circuit $v_{load}(t)$ is zero (see Figure 4). Next, assume that a constant positive control voltage equal to one-half of the peak reference voltage is applied to the circuit. The resulting output voltage is a train of pulses with a 50 percent duty cycle, as shown in Figure. Finally, assume that a sinusoidal control voltage is applied to the circuit as shown in Figure 3–58. The width of the resulting pulse train varies sinusoidal with the control voltage. The result is a high-power output waveform whose average voltage over any small region is directly proportional to the average voltage of the control signal in that region. The fundamental frequency of the output waveform is the same as the frequency of the input control voltage. Of course, there are harmonic components in the output voltage, but they are not usually a concern in motor-control applications. The harmonic components may cause additional heating in the motor being driven by the inverter, but the extra heating can be compensated for either by buying a specially designed motor or by derating an ordinary motor. A complete three-phase PWM inverter would consist of three of the single-phase inverters described above with control voltages consisting of sinusoids shifted by 120° between phases. Frequency control in a PWM inverter of this sort is accomplished by changing the frequency of the input control voltage. Pulse Width Modulation or PWM technology is used in Inverters to give a steady output voltage of 230 or 110 V AC irrespective of the load. The Inverters based on the PWM technology are more superior to the conventional inverters. The square wave inverter are very simple and easy to make but that is not suitable for sensitive Electric appliances, Modified sine wave inverters are gives output as close as to the sine wave but not pure as much we have receive from wall outlet. PWM (Pulse Width Modulation) signal based inverters SPWM (Sine–triangle pulse width modulation) signals are used in micro-inverter design (used in solar and wind power applications).

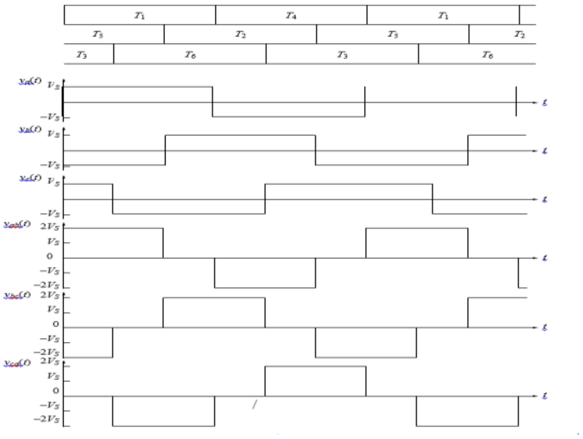


Fig. 3 PWM Waveform

A PWM inverter switches states many times during a single cycle of the resulting output voltage. At the time of this writing, reference voltages with frequencies as high as 12 kHz are used in PWM inverter designs, so the components in a PWM inverter must change states up to 24,000 times per second. This rapid switching means that PWM inverters require faster components than CSIs or VSIs.

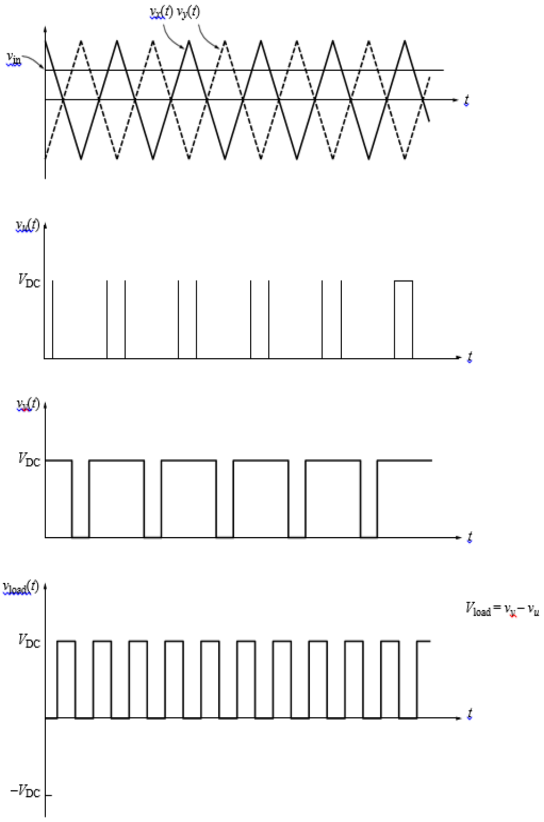


Fig. 4 Gate Pulse

PWM inverters need high-power high-frequency components such as GTO thyristors, IGBTs, and/or power transistors for proper operation. (At the time of this writing, IGBTs have the advantage for high-speed, high-power switching, so they are the preferred component for building PWM inverters.) The control voltage fed to the comparator circuits is usually implemented digitally by means of a microcomputer mounted on a circuit board within the PWM motor controller. The control voltage (and therefore the output pulse width) can be controlled by the microcomputer in a manner much more sophisticated than that described here. It is possible for the microcomputer to vary the control voltage to achieve different frequencies and voltage levels in any desired manner. For example, the microcomputer could implement various acceleration and deceleration ramps, current limits and voltage versus frequency curves by simply changing options in software.

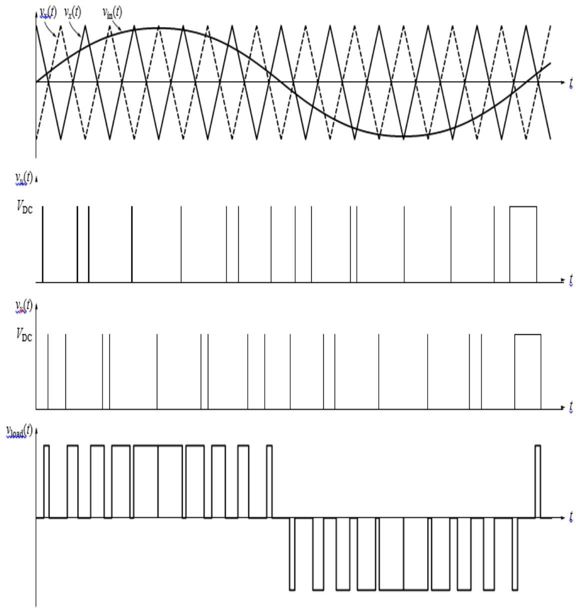


Fig. 5 Gate Pulse

C. *Three phase load*

Three Phase Load Is Mostly Asynchronous Motor (Induction Motor). Because It Is Low Cost, Less Maintenance Cost, Highly Efficient. In Most Of The Industries Mainly The Induction Motors Are Used.

IV. BLOCK DIAGRAM

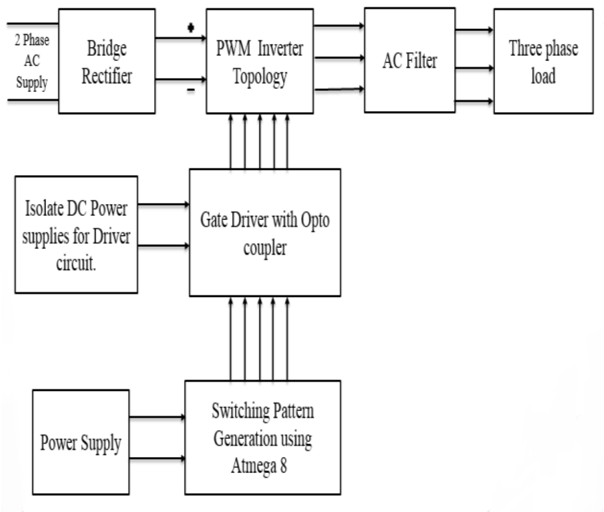


Fig. 6 Block digram

V. MATLAB

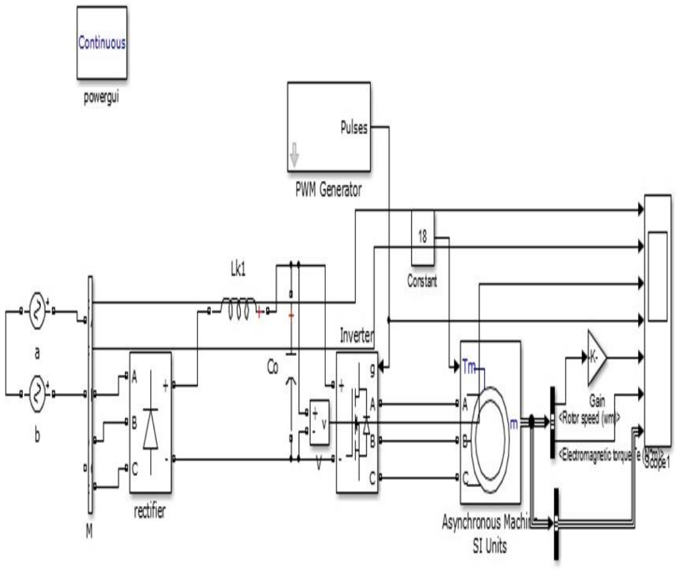
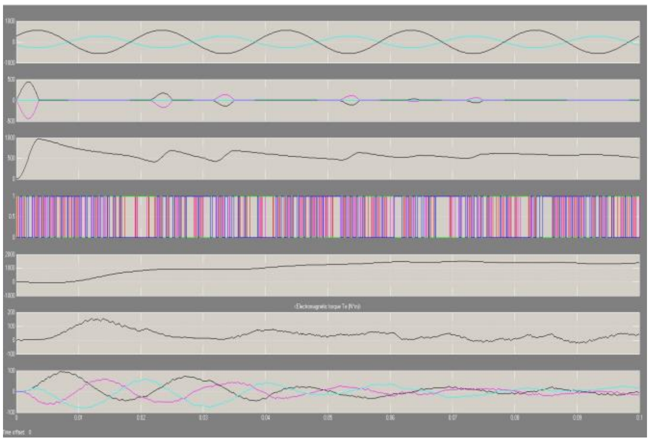


Fig. 7 MATLAB simulink

A. WAVE FORM



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