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POWER FACOR CORRECTED ZETA CONVERTER BASED IMPROVED POWER QUALITY SWITCHED MODE POWER SUPPLY

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Abstract-Power Factor, the ratio between the real or average power and the apparent power forms a very essential parameter in power system. It is indicative of how effectively the real power of the system has been utilized. With rapid development in power semiconductor devices, the usage of power electronic systems has expanded to new and wide application range that include residential, commercial, aerospace and many others. Power electronic interfaces e.g. switch mode power supplies (SMPS) have proved to be superior over traditional linear power supplies. The current drawn by the SMPSs from the line is distorted resulting in a high Total Harmonic Distortion (THD) and Low Power Factor (PF).Hence, there is a continuous need for power factor improvement and reduction of line current harmonics. Development of new circuit topologies and control strategies for Power Factor Correction (PFC) and harmonic reduction has become still more essential with the introduction of strong technical IEC standards. The work initially involves simulation of basic power electronic circuits and the analysis of the current and voltage waveforms. It starts with simple circuits with a gradual increase in complexity by inclusion of new components and their subsequent effect on the current and voltage waveforms. We focus on the objective of improving the input current waveform i.e. making it sinusoidal by tuning the circuits.
Keywords: PFU Unit, ARDUINO controller.

I. INTRODUCTION

In electrical engineering, power conversion has a more specific meaning, namely converting electric power from one form to another. Some of these converters have found places in industry for a variety of applications.Practical electronic converters use switching techniques. Switched-mode DC-DC converters convert one DC voltage level to another, which may be higher or lower, by storing the input energy temporarily and then releasing that energy to the output at a different voltage. The storage may be in either magnetic field storage components (inductors, transformers) or electric field storage components (capacitors). There are also devices and methods to convert between power systems designed for single and three-phase operation. One way of classifying power conversion systems is according to whether the input and output are Alternating Current (AC) or Direct Current (DC).Now here comes the problem: In an alternating current (AC) electrical supply, a mysterious thing called "Power Factor" comes into play. Power Factor is simply the measure of the efficiency of the power being used, so, a power factor of 1 would mean 100% of the supply is being used efficiently. A power factor of 0.5 means the use of the power is very inefficient or wasteful .So what causes Power Factor to change? In the real world of industry and commerce, a power factor of 1 is not obtainable because equipment such as electric motors, welding sets, fluorescent and high bay lighting create what is called an "inductive load" which in turn causes the amps in the supply to lag the volts. The resulting lag is called Power Factor.

II. EXISTING SYSTEM

The exisiting system is a boost converter is sometimes called a step-up converter since it "steps up" the source voltage. A boost converter is a DC-DC power converter steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of Switched Mode Power Supply (SMPS) containing at least two semiconductors (a diode and a transisor) and at least one energy storage element, a capacitor,inductor,or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).The switch is typically a MOSFE, IGBT or BJT.

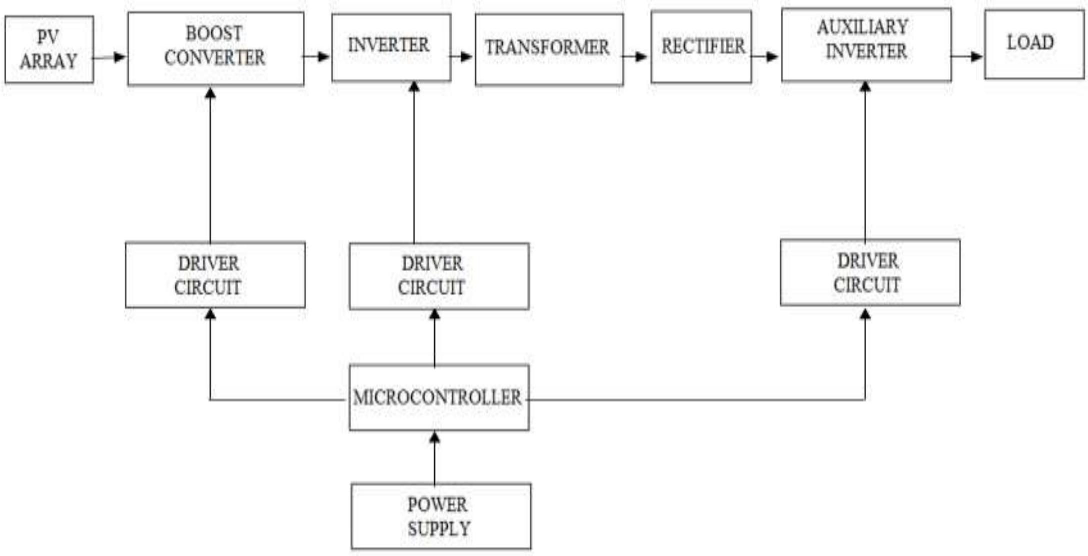

Figure 1 Block Diagram

III. PROPOSED SYSTEM

A ZETA Converter is a non isolated power factor corrected (PFC) converter is being proposed to improve the power quality of an SMPS for a PC. It allows a regulated output voltage with only one power processing stage. Analysis of ZETA Converter operating in discontinuous conduction mode for power factor correction. All other converters corrects the power factor with intrinsic limitations except ZETA Converter.The improved PQ SMPSs that are capable of drawing a sinusoidal input current at unity power factor (UPF) and yielding stiffly regulated output voltages, are extensively being researched. Employing various power factor corrected (PFC) single-stage and two stage converters effect a perceivable PQ improvement in these SMPSs [6-10This is achieved even under varying loads and supply voltage conditions.The selection of operating mode of the front end converter may be in Discontinuous Conduction Mode (DCM) if the cost is a major consideration; if not, Continuous Conduction Mode (CCM) is adopted that reduces device stresses, despite the fact that CCM uses two voltage and one current sensors which naturally makes it costlier.

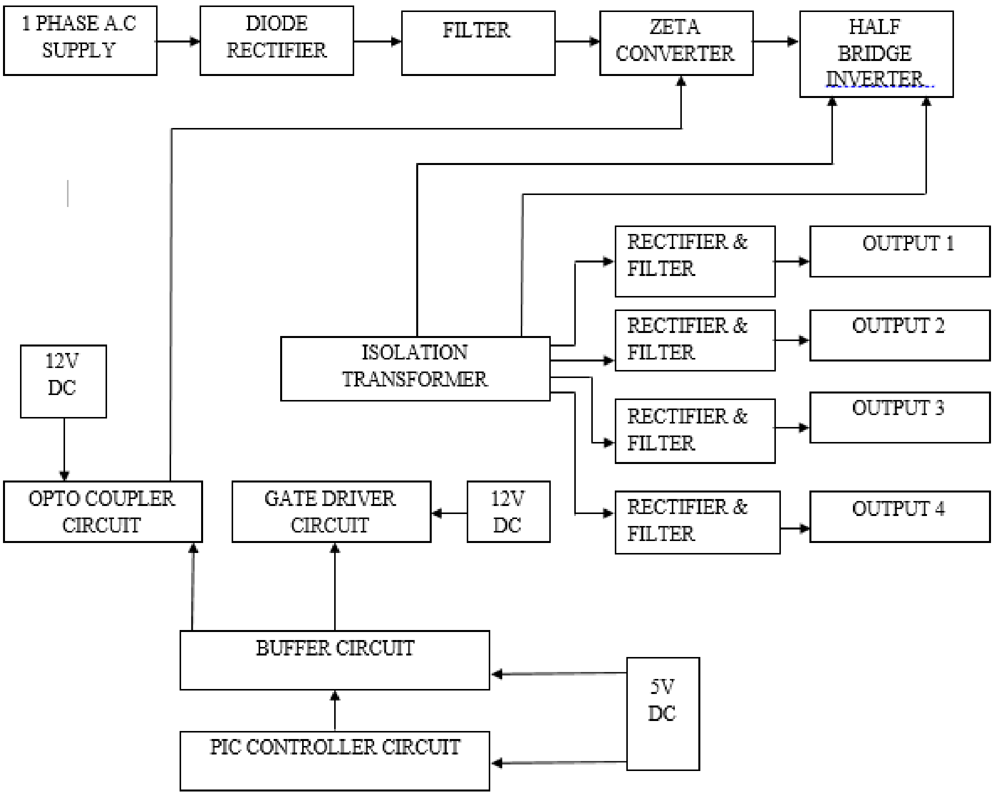

Figure 2. Block Diagram

IV. WORKING

A Zeta PFC converter is still unexplored for the development of computer SMPSs that are capable of drawing a purely sinusoidal current with unity PF, offering low rippled output which is the prime requirement of PCs.A ZETA Converter is a non isolated power factor corrected (PFC) converter is being proposed to improve the power quality of an SMPS for a PC.It allows a regulated output voltage with only one power processing stage. Analysis of ZETA Converter operating in discontinuous conduction mode for power factor correction. All other converters corrects the power factor with intrinsic limitations except ZETA Converter.

In thyristor driver circuits, appropriate control signals are used to generate gate current pulses in order to trigger the thyristor. A transformer often isolates the control circuit from the high voltages of the power circuit. .Principle of a thyristor driver circuit. The firing pulses are repeated several times in order to ensure that the pulses exceed the thyristor's latching current. The latching current is the minimum gate current required to trigger the thyristor. MOSFET and IGBT Driver Circuits IGBT and MOSFET drivers are very similar in that both components are controlled by voltage (charging the gate capacitor). The insulation between the gate and the emitter is made of thin silicon oxide. A maximum voltage of 20V to 25V must never be exceeded in order to ensure that the oxide layers remain intact. Functions of Typical Driver Circuits The diagram below shows an example of an IGBT half-bridge driver circuit.

Geared DC motors can be defined as an extension of DC motor which already had its in sight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction

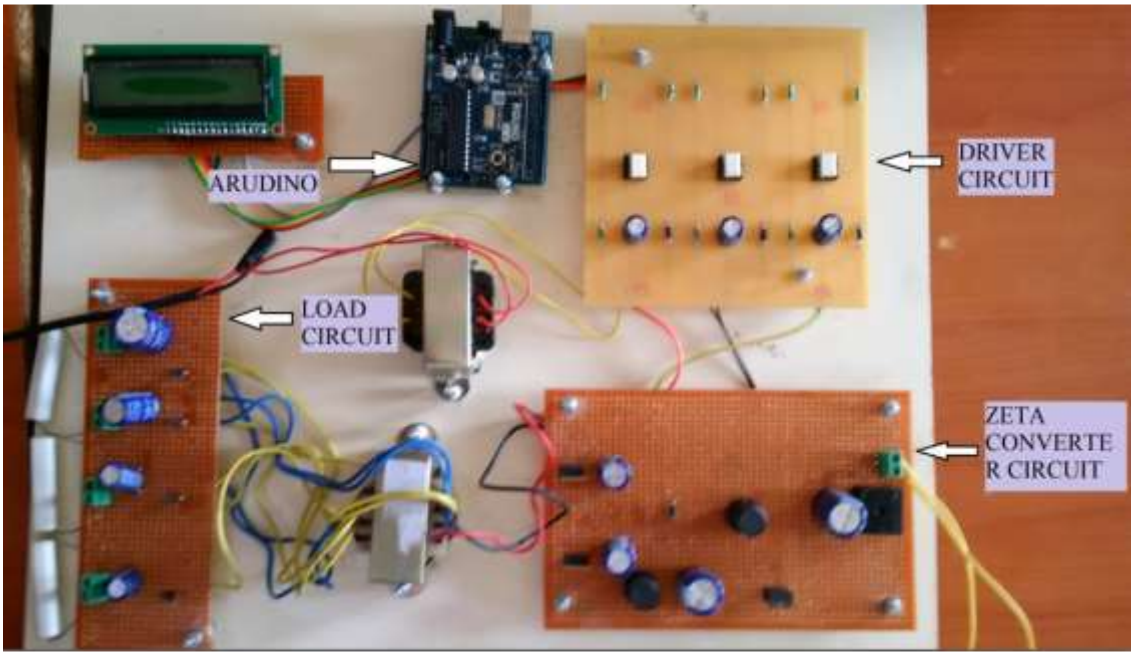

Figure 3. Hard ware circuit module

V. CONCLUSION

The main objective throughout the project has been to improve the input Power Factor with simultaneous reduction of input current harmonics. Simulations were initially done for elementary rectifier circuits without employing any PFC circuit. These simulations included circuits with and without source side inductors and capacitors. The changes in the input current waveform were observed and studied. A PFC circuit having a parallel boost converter i.e. two boost converters arranged in parallel was designed.The control strategy was based on average current mode control due to its relative advantages over voltage mode control and peak current mode control.

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