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POWER QUALITY IMPROVEMENT OF NON-LINEAR ELECTRICAL LOAD BY USING ARTIFICIAL NEURAL NETWORK (ANN) FOR HARMONIC REDUCTION

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Abstract

This paper presents a single-phase Multilevel critical conduction mode (CRM) power factor correction buck-boost converter with a variation-tolerant phase shifter (VTPS), which ensures accurate 180◦ phase shift between the Bridgeless Multilevel converters. A feedback loop similar to a phase-locked loop controls the amount of the phase shifting of the VTPS. The proposed VTPS has better immunity of process, supply, and temperature variations than the conventional phase shifter. A single-phase Bridgeless Multilevel CRM boost converter prototype has been implemented, while the proposed VTPS and conventional interleaving phase shifter can be selectively applied to compare the performance of the proposed technique with the conventional one. Experimental results show that the two-phase Bridgeless Multilevel CRM boost converter has better performance with the proposed VTPS. The proposed VTPS circuit can be applied to any type of Bridgeless Multilevel switching power converter

Keywords:

Artificial Neural Network (ANN), Bridgeless Multi Level Inverter DC-DC converter, SHEPWM, V,I measurement

I. INTRODUCTION

A Single Phase Single Stage Power Factor Corrected (SSPFC) AC/DC converter that operates with a single controller to obtain regulated dc output voltage is presented in this paper. The proposed converter integrates the operation of a boost power factor correction converter and a three-level and five level DC/DC converter into one converter. Due to the cost of having two separate and independent converters, there has been considerable research on so-called single-stage converters. Converters that can simultaneously perform AC-DC and DC-DC conversion with only a single converter stage. Elimination of one of these stages reduces the cost, weight, size, complexity and increase the overall reliability of this converter. The focus of the topology is to reduce the DC bus voltage at light load without compromising with input power factor and voltage regulation. The concept behind this topology is direct power transfer scheme. The proposed converter is having an input power factor close to unity and better voltage regulation and THD will be reduce compared to the conventional ac-dc converter topologies. The output wave is shown using Matlab/Simulink. This paper discusses a shunt active filter intended for installation on a power distribution system. The active filter has an additional capability to regulate the distribution line voltage by means of adjusting reactive power. Theoretical analysis investigates the dynamic performance of combined reactive power damping and voltage regulation. As a result, reactive power damping makes it possible to improve the stability of the control loop for voltage regulation, and the combined reactive power damping. The system with control scheme is implemented using Matlab/Simulink. The simulation results are shown to verify the effectiveness of the combined reactive power damping and voltage regulation power quality gains its importance with the introduction of sophisticated electrical gadgets. The performances of these devices are sensitive to the quality of input power supply. Various power quality problems results in failure or mal-operation of end user equipment. Some of the major power quality issues are voltage sag, voltage swell and reactive powers. To solve these problems, capacitors, voltage regulators and filters, are conventionally used. These techniques involve inherent drawbacks. Christo Ananth et al.[4] presented a brief outline on Electronic Devices and Circuits which forms the basis of the Clampers and Diodes.So it is proposed to use Flexible AC Transmission System (FACTS) devices for the mitigation of power quality problems. With the usage of these devices, drawbacks associated with conventional methods can be overcome easily. The application of FACTS devices provides faster control and enhances the way of using the transmission system at their rated thermal capability. In this work, it is proposed to use Static VAR Compensator (MLI) for mitigating voltage sag and reactive powers by providing proper reactive power support.

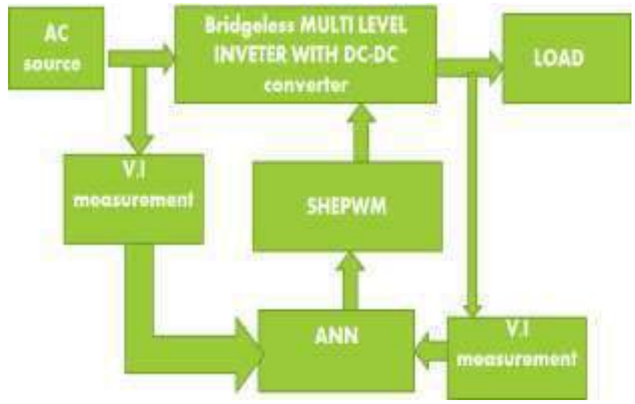

Fig. No. 1 Block Diagram of the Proposed System.

Power factor correction has included for input power efficiency ANN has influencing in this system for compensating the Harmonics. It is very accurate and fast response so harmonics is lower than 2% SHEPWM is used to reduce the harmonic losses in MLI The problem of eliminating harmonics in switching converters has been the focus of research for many years. Present day available PWM schemes can be broadly classified as carrier modulated sine PWM and pre calculated programmed pulse width modulation (PPWM) schemes. If the switching losses in an inverter are not a concern switching on the order of a few kHz is acceptable then the sine-triangle PWM method and its variants are very effective for controlling the inverter This is because the generated harmonics are beyond the bandwidth of the system being actuated and therefore these harmonics do not dissipate power. On the other hand, for systems where high switching efficiency.

METHODOLOGY

A .ARTIFICIAL NEURAL NETWORK (ANN)

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The general idea Control (ANN) is to create a closed loop controller with parameters that can be updated to change the response of the system. The output of the system is compared with the desired response from a reference model. The control parameters are updated based on this error. The goal is for the parameters to converge to ideal values that cause the plant response to match the response of the reference model. It may choose a reference model that could respond quickly to a step input with a short settling time. The optimal angles evolved by PSO are the solution for a given desired output voltage. Solutions of other desired output voltage value are different. In some applications, output voltage is required to be continuously changed according to the user command. It is impossible to evaluate the optimal solution for overall desired output voltage. However, in order to overcome this problem, data set of optimal angles evolved by PSO for some given desired output voltages are used as training set for artificial neural network (ANN) [5].

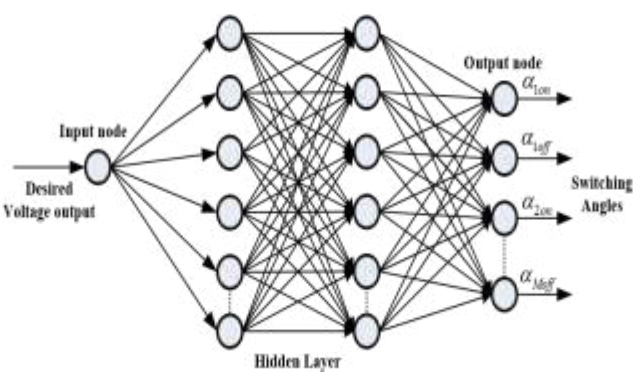

Fig. No. 2 Layer model of the ANN Structure

B. SELECTIVE PWM CONTORL

The two-state output waveform of the single-phase inverter is approached from an analytical point of view and a generalized method for theoretically eliminating any number of harmonics is developed. The basic square wave is chopped a number of times and affixed relationship between 142 the number of chops and possible number of harmonics that can be eliminate is derived. The term "computed PWM" (CPWM) is coined because the generation of PWM by this method is just by computing an interpolated repeated sequence and directly using these values to generate the waveform. As a result, large number of trials is involved in this method. Also the timer equired to form the interpolated sequence is far less than that required for the sine-triangular comparison method. Since there are no direct tools for creating the wave form that is needed for this work, the required wave is created from the zero-crossings of a variable frequency triangular wave, which switches atpre-specified or programmed instants (Enjeti et al 1990). This method has 162 been found to simple but effective method to generate a wave of required

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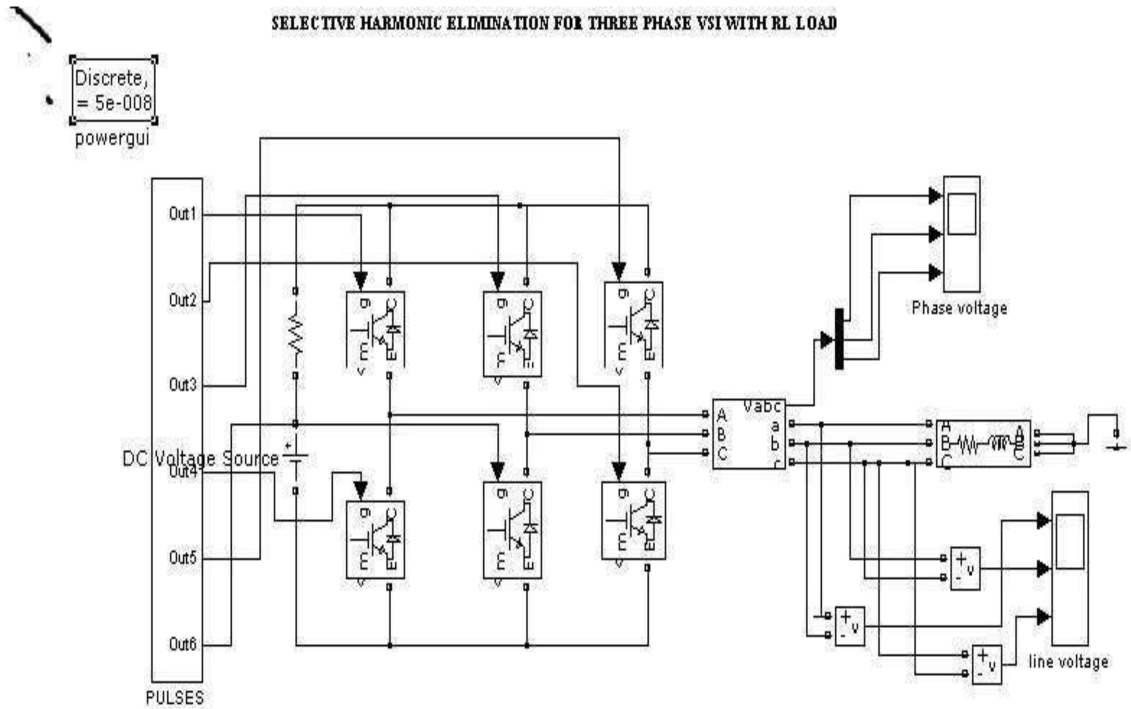

Fog. No. 3 Simulation diagram of the proposed system.

Three-Level Integrated DC-DC Converter:

A Three-Level Integrated DC-DC Converter a new integrated three-level ac–dc converter is presented. The proposed converter integrates the operation of the boost power factor correction and the three-level dc–dc converter. The converter is made to operate with two independent controllers an input controller that performs power factor correction and regulates the dc bus and an output controller that regulates the output voltage. The input controller prevents the dc-bus voltage from becoming excessive while still allowing a single-stage converter topology to be used. The paper explains the operation of the new converter in detail and discusses its features and a procedure for its proper design. Experimental results obtained from a prototype are presented to confirm the feasibility of the new converter.

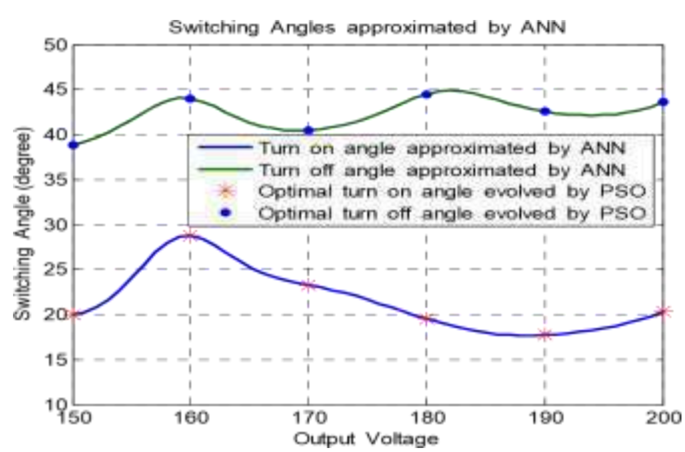

Fig. No. 4 Simulation Result of the Proposed System

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C. **Microcontroller details**:

Memory: It has **8 Kb** of Flash program memory (10,000 Write/Erase cycles durability), **512 Bytes** of EEPROM (100,000 Write/Erase Cycles). **1Kbyte** Internal SRAM

I/O Ports: 23 I/ line can be obtained from three ports; namely Port B, Port C and Port D.

Interrupts: Two External Interrupt source, located at port D. 19 different interrupt vectors supporting 19 events generated by internal peripherals.

Timer/Counter: Three Internal Timers are available, two 8 bit, one 16 bit, offering various operating modes and supporting internal or external clocking.

USART: One of the most powerful communication solutions is USART and ATmega8 supports both synchronous and asynchronous data transfer schemes. It has three pins assigned for that. In many projects, this module is extensively used for PC-Micro controller communication

Microcontroller

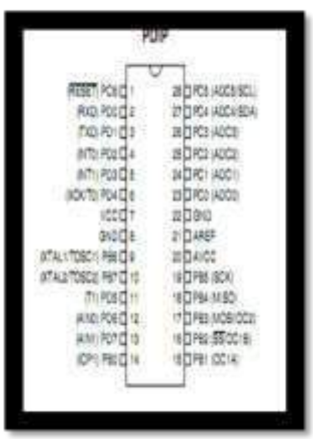

Fig. No. 5 Pin Diagram description of Microcontroller

In this paper microcontroller is used to Read Power factor from input by using CT and PT and it is also used to give pulses to multilevel converter to maintain voltage stability and improve power factor and also used to display PF in LCD.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega8A is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

D. Adaptive neuro-fuzzy inference system (ANFIS)

The basic structure of Mamdani fuzzy inference system is a model that maps input characteristics to input membership functions, input membership functions to rules, rules to a set of output characteristics, output characteristics to output membership functions, and the output membership functions to a single-valued output or a decision associated with the output. Such a system uses fixed membership functions that are chosen arbitrarily and a rule structure that is essentially predetermined by the user's interpretation of the characteristics of the variables in the model. ANFIS and the Neuro-Fuzzy Designer apply fuzzy inference techniques to data

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modelling. As you have seen from the other fuzzy inference GUIs, the shape of the membership functions depends on parameters, and changing these parameters change the shape of the membership function. Instead of just looking at the data to choose the membership function parameters, you choose membership function parameters automatically using these Fuzzy Logic Toolbox™ applications. Suppose you want to apply fuzzy inference to a system for which you already have a collection of input/output data that you would like to use for modelling, model-following, or some similar scenario. You do not necessarily have a predetermined model structure based on characteristics of variables in your system. In some modelling situations, you cannot discern what the membership functions should look like simply from looking at data. Rather than choosing the parameters associated with a given membership function arbitrarily, these parameters could be chosen so as to tailor the membership functions to the input/output data in order to account for these types of variations in the data values. In such cases, you can use the Fuzzy Logic Toolbox *neuro-adaptive* learning techniques incorporated in the ANFIS command. The neuro-adaptive learning method works similarly to that of neural networks. Neuro-adaptive learning techniques provide a method for the fuzzy modelling procedure to *learn* information about a data set. Fuzzy Logic Toolbox software computes the membership function parameters that best allow the associated fuzzy inference system to track the given input/output data. The Fuzzy Logic Toolbox function that accomplishes this membership function parameter adjustment is called ANFIS. The ANFIS function can be accessed either from the command line or through the Neuro-Fuzzy Designer. Because the functionality of the command line function ANFIS and the Neuro-Fuzzy Designer is similar, they are used somewhat interchangeably in this discussion, except when specifically describing the GUI.

FUTURE ENHANCEMENT

In this method we using ANFIS controller so it helps to improve the PF nearly to 0.99 and above And we using output feedback closed loop method so there is constant voltage maintenance and ripple reduction in output And efficiency will increase.

CONCLUSION

A new single stage three level ac-dc converter, its basic operating principle and design are presented in the paper. The new converter performs both the power factor correction and the voltage regulation in a single stage. It uses two separate controllers for performing power factor correction and output voltage regulation. The summary of the limitations of existing single stage topologies is also presented. The advantageous features of the proposed converter are due to the fact that it is a five-level converter that allows the uncontrolled primary-side dc bus voltage to be higher than what can be allowed for three-level converters. Hence from the outputs of the conventional two stage converter and proposed single stage converter it is clear that power factor is improved and the total harmonic content is reduced with the proposed one. Simulation results obtained from models are also presented to confirm the feasibility of the new converter

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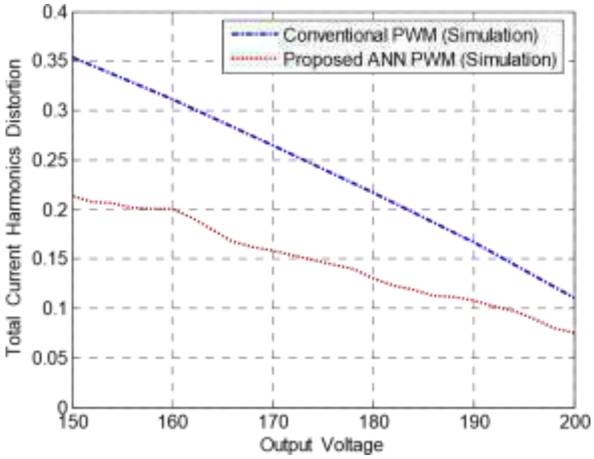

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Comparison of THD_i from the proposed techniques, conventional technique PWM for some given desired output voltage.

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