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Fuzzy Logic Controlled Selective Harmonic Eliminated Three Phase Z-Source Inverter for Wireless AC Transmission

Kannan. P[1], Dr S China Venkateshwarlu[2], Blessie Beulah. K[3]

Assistant Professor, Electronics and Communication Engineering, Francis Xavier Engineering College, Tirunelveli.

Professor, Electronics and Communication Engineering, Francis Xavier Engineering College, Tirunelveli.

PG Student, Electronics and Communication Engineering, Francis Xavier Engineering College, Tirunelveli.

Abstract: This research work proposes a new topology for three phase z-source inverter by changing switching pulse using Pulse Width Modulation (PWM) to minimize the harmonic problem. It provides Selective Harmonics Elimination (SHE) to eliminate harmonics produced by Pulse Width Modulation (PWM) inverter. The lower order harmonics (3rd, 5th, 7th, 9th) are eliminated by dominant harmonics by Pulse Width Modulation (PWM) inverter by using Total Harmonic Distortion (THD) is reduced. Harmonics are the major problem power quality problem for power systems. Normally, Z-Source inverter has to convert direct current to alternating current signal. To reduce harmonics and transmit for long distance wireless alternating current. The harmonic distortion in the three phase Z source inverter has to reduce 4.75% to the proposed modulation scheme. Then the harmonic free signal can be transmitted. The Selective Harmonic Elimination (SHE) is simulated using MATLAB/SIMULINK software.

Keywords: Three phase Z-source inverter (ZSI), Selective Harmonic Elimination (SHE), Pulse Width Modulation (PWM), Fuzzy Logic.

I. INTRODUCTION

The term harmonics referred to Power quality in ideal world would mean how pure the voltage is, how pure the current waveform is in its sinusoidal form. Power quality is very important to communication systems. Ideally, the electrical supply should be a perfect sinusoidal waveform without any kind of distortion. If the current or voltage waveforms are distorted from its ideal form it will be termed as harmonic distortion. This harmonic distortion could result because of many reasons. In today's world, prime importance is given by the engineers to derive a method to reduce the harmonic distortion. Harmonic distortion was very less in the past when the designs of power and communication systems were very simple and conservative. But, nowadays with the use of complex designs in the industry harmonic distortion has increased as well.

This project explains the effects of Harmonics in the Power and communication System and steps to reduce the effects of Harmonics. This project will also explain how Harmonic distortion is one of the most important problems associated with power quality and creates several disturbances to the communication and Power System.

Harmonics are the major problem in both communication and the power system. Inverter has to convert alternating input current to the direct output current. Normally, large number of inverter was there. To reduce total harmonic distortion, reduce losses and improve reliability [1].But, we can use Z-Source inverter to reduce harmonics. Use Shoot-through State, Non-shoot-through State to reduce the low shoot-through duty cycle and provide low total harmonic distortion in current source inverter [4]-[5]. To reduce the second order harmonics, total harmonic distortion and improve their performance need high power by active power filter algorithm [6]-[8]. Normally voltage source inverter widely used in the fuel cell and photovoltaic cell. Use Transformer Less Shunt Hybrid Power Filter to reduce total harmonic distortion then, it can be provide efficient power quality to minimize the maintenance cost but not used in the complex mathematical modeling [5]. In pulse width modulation and sinusoidal pulse width modulation can

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be eliminate the lower order harmonics, improve the output voltage, the percentage of the total harmonic distortion is low [7]-[8]. Selective harmonic elimination can be minimize total harmonic distortion, accuracy and provide better efficiency [12]

II. Existing System

The existing system proposes a Phase-shift control and harmonics elimination for H-bridge Z-source inverter. Phase shift control method of Z-source inverter based on traditional H-bridge inverter. It can be Eliminate several lower order harmonics. The phase-shift control method for H-bridge ZSI, which its main difference with phase-shift control of traditional H-bridge inverters is existence of four shoot-through states (short circuit of the H-bridge) in each switching cycle. The existing method is simultaneous elimination of several harmonics by choosing the appropriate switching angles. Moreover, by using this phase-shift control method, the amplitude of low-order harmonics for many values of switching angles is less than the amplitude of low-order harmonics in traditional H-bridge voltage source inverter (VSI). Total harmonic distortion and distortion factor, as two important indexes for the proposed method, are calculated and compared with their values in traditional H-bridge VSI.

Extended maximum boost control scheme based on single-phase modulator for three-phase Z-source inverter. The control method for Z-source inverter (ZSI) – called the one-dimension ZSI (ODZSI) – based on the single-phase modulator technique. The notable feature of the proposed control compared with the space vector modulation strategy is its reduced computational processing time, which is attractive for digital implementation. Compared with the maximum boost control (MBC), which uses carrier-based pulse width modulation control methods, the algorithm enhances the output voltage and current quality. In this study, the results of MBC are compared with those obtained with a single-phase modulator for three-phase ZSI showing its the line output current and voltage total harmonic distortion. It can be used for further industrial applications of ZSIs.

The major drawback of the existing system is based only on the single-phase modulator for three-phase Z-source inverter and also H-bridge Z-source inverter. Total harmonic distortion is very high.

III. Proposed System

A. DC Source

Direct current can be produced by the source of battery, solar cell, power supply. It flows the current only on unidirectional flow of electric charge. It will supplies a constant direct current voltage to its load. It provides direct current to the impedance network.

B. Impedance Network

It is an x-shaped network. It can be placed between the DC source and the z-source inverter. It can be improve the system performance.

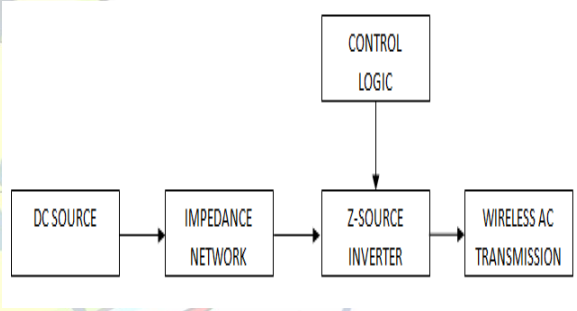

Fig.1 Block diagram of proposed system

C. Z-Source Inverter

Normally, inerter can be used to convert direct current to the alternating current. PWM method is used for controlling the inverter output voltage.

D. Control Logic

It can be used on the fuzzy logic controller to provide their performance. Fuzzy logic controller can be used only on 0 and 1. It controls the program operations. Fuzzy logic can be controlled by firing the pulse from pulse generator whose values are parameterized. The duty cycle (i.e) ON and OFF time of the switch gets tuned.

E. Output

The harmonic free alternating current can be used to transmit for long distance wireless AC transmission.

IV. Simulation Results & Discussion

We can discussed in the results and achieved goals of this study. Inverters were built in the Simulink software followed by assigning appropriate values for each and every component in the circuit. By adding voltage measurement block to the system, the output inverter voltage waveform can be retrieved. Just like voltage measurement, current waveform would get retrieved too. In most of the

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applications, inverters get used to run motors which convert the electrical energy into mechanical energy. To know about the speed of the motor runs, asynchronous machine gets plugged with scope to witness. Harmonics chart is obtained by considering percentage of fundamental against distortion order of the harmonics. The Total Harmonic Distortion measures the total harmonic distortion (THD) of a periodic distorted signal. The signal can be measured voltage or current.

In this model the fuzzy logic can be controlled by firing the pulse from pulse generator whose values are parameterized. The duty cycle (i.e) ON and OFF time of the switch gets tuned. The X-Shaped network can be placed between source and main inverter bridge. The Shoot through i.e) gating of upper and lower switch can be provided. The above figure configuration in Z-Source inverter. VSI differs from ZSI in prohibition of shoot through mode and little changes in the impedance network. The output voltage, output current and total harmonic distortion can be scoped by installing the voltage and current measurement in Simulink models.

The current waveforms were scoped by connecting the terminals of the current measurement cell to the phase cell of the inverter bridge. The above current waveforms represent for phase leg a, phase leg b, phase leg c.

From the voltage waveform, the following parameters can be measured such as line voltage, peak to peak voltage and phase peak voltage. The voltage waveforms were scoped by connecting the terminals of the voltage measurement cell to the phase legs of the inverter bridge. The above voltage waveforms displayed for phase leg a, phase leg b, phase leg c respectively.

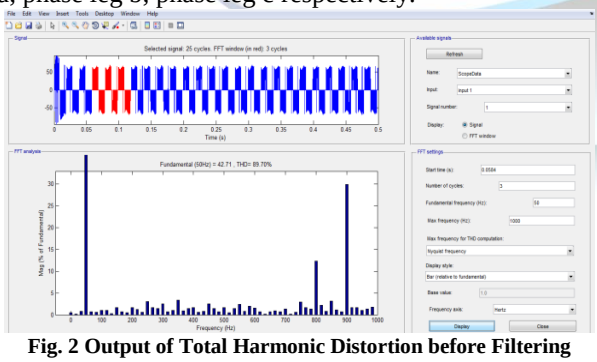

Fig. 2 Output of Total Harmonic Distortion before Filtering

The Total Harmonic Distortion measures the Total Harmonic Distortion (THD) of a periodic distorted signal. The signal can be measured voltage or current. The THD is defined as the root mean square (RMS) value of the Total Harmonics of the signal, divided by the RMS value of its fundamental signal. The harmonic analysis tells that ZSI reduces the disturbances intelligently when compared to ordinary inverters. The higher order harmonics value is negligible since that gets after filtering by the impedance network. The percentage of Total Harmonic Distortion can be reduced as 4.74%

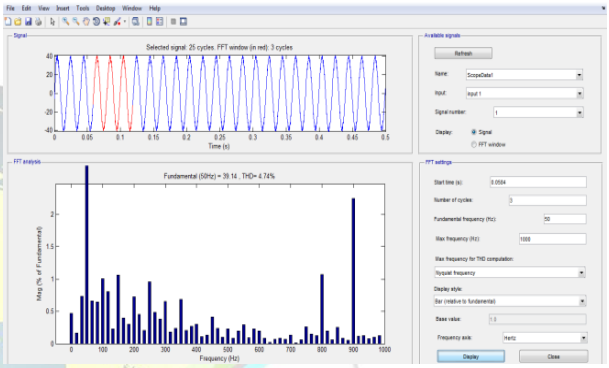

Fig. 3 Output of Total Harmonic Distortion after Filtering

V. CONCLUSION AND FUTURE ENHANCEMENT

In the field of communication and power system feedback has been considered as a common and powerful technique. It takes the system output into consideration which enables the system to adjust its performance to meet a desired output response. New emerging architecture named Z-Source inverter which has both boosting and bucking quality has been structured with feedback and implemented too. Even with the EMI interference, it won't get damaged since the shoot through mode is most welcome in ZSI. Controlling can be enabled by the introduction of artificial intelligence technique namely fuzzy logic controller has been established. The output is sensed and compared with reference voltage. This project focuses on the development of ZSI followed by their harmonics study. Harmonics has been considered as the recent research topic these days, especially in adjustable speed equipment performance. It can be controlled by monitoring and analyzing the whole system, determining safe harmonic levels. PWM generation technique has been took as an pulse firing device followed by all the analysis of harmonics value.

We can reduce harmonics using z-source inverter. Usually, z-source inverter converts direct current to alternating current. We reduce the fluctuation using pulse

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width modulation by the introduction of fuzzy logic technique the whole system has been controlled. It can be controlled by monitoring and analyzing the whole system, determining safe harmonic levels. Then the harmonic free signal sends to wireless ac transmission for long distance communication. In future we can reduce the individual harmonics level. Then it can also implement in the current source inverter and multilevel inverter.

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