Performance Comparison of PMSG fed Switched Inductor based Quasi Impedance Source Inverter using Different PWM Technique

S. Sivaganesan, Shaik Mohammed Khaja, Vetriveeran Rajamani

Abstract: ***PWM technique mainly is used for reducing the current harmonic and controls the speed of the motor in industries. Many PWM techniques are developed for harmonic reduction. In this paper single pulse width modulation (single PWM), Sine PWM (SPWM) and trapezoidal PWM (TPWM) methods are proposed for control the switched inductor based quasi impedance source inverter (SL-QZSI). The proposed circuit is simulated using three PWM techniques in MATLAB environment. The circuit performance is compared with simulation results. The proposed circuit has more voltage gain in single PWM method and has less current harmonic distortion in TPWM method. The circuit results and operation is present.***

Index Terms: PWM Technique, Switched Inductor, Voltage Gain, Harmonic and Inverter

I. INTRODUCTION

Pulse Width Modulation technique produces variable ac output voltage where the input of the inverter is supplied with fixed dc voltage. It is achieved by adjusting the duty ratio of the inverter switching pulses. It gives the best results compared to any other external control method [1]. These techniques affect the system performance directly [2]. Different PWM method is used to control the output voltage and current harmonic [3-4]. Each method has advantages as well as disadvantages compare than other method. Single PWM is a basic control method and produce even pulse width for all pulses. SPWM is the best control method compare than single PWM method because SPWM produce variable pulse width in each pulse [5]. But this method has some draw backs such as more total harmonic distortion (THD) lower effective utilization of DC value [6]. Trapezoidal PWM method is used to improve the system performance such as reduce the current harmonic and improve the power quality [7].

Many research works is going on continuously to improve the impedance source inverter voltage gain and reduce the current harmonic compare than previous version [8-9]. PWM method with shoot through concept is applied for increase the voltage gain and reduces the harmonic of the impedance source inverter [9-10]. The switched inductor based quasi impedance source inverter is proposed in this paper. Different PWM method is applied for improving the system performance. The circuit performance is compared using simulation results. The following section describes the simulation results and discussion.

II. CIRCUIT DESCRIPTION

The PMSG based power generation system is as shown in fig 1. This circuit consists wind turbine, PMSG, rectifier, switched inductor based quasi impedance source (Sl-Qzi) inverter and motor load. The wind generator generates the ac voltage it's given to rectifier for converting ac to dc. This dc supply is fed to Sl-Qzi for converting dc to ac with voltage boosting. Impedance network consists of three inductors (L1, L2, and L3), two capacitors (C1 and C2), and four diodes (D1, D2, D3 and D4). The combination of L1–L3–D1–D2–D3 performs the function of the SL cell This SL cells are used to store and transfer the energy from the capacitors and dc source to the dc bus under the switching action of the main circuit. The impedance network with inverter produces the constant voltage with fixed frequency output. This ac voltage is given to the motor load. The circuit operation is explained in detail [11].2.1. The paper should have the following structure.

III. PWM TECHNIQUE

Figure 2 shows the single pulse PWM generation method and pulse pattern. In this method DC reference signal is compared with triangular carrier signal. Each pulse having equal pulse width. Figure 3 shows the Sine PWM pulse generation method and pulse pattern. In this method AC reference is compared with triangular carrier signal. Each pulse having different width in one half cycles it is giving better voltage regulation and harmonic reduction

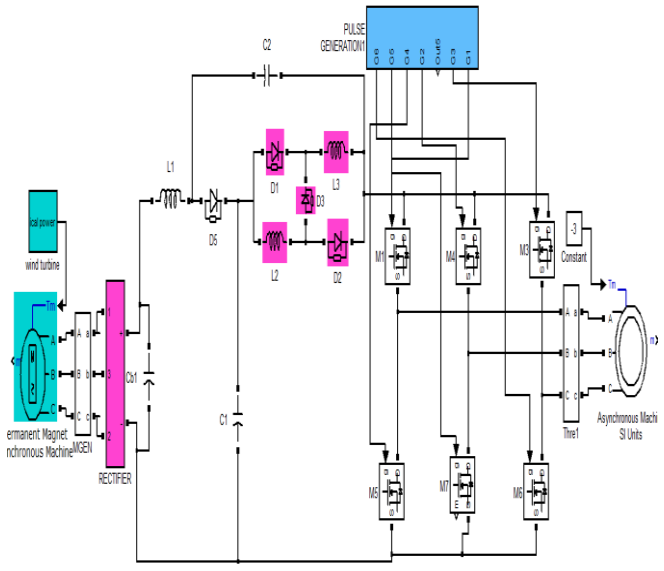

Fig. 1: Switched inductor based quasi impedance source (Sl-Qzi) inverter

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Fig.4 shows the trapezoidal PWM pulse generation method and pulse pattern. In this method trapezoidal carrier signal is compared with sine reference signal. Each pulse having different pulse width in each half cycle. It is giving better voltage regulation and harmonic reduction .

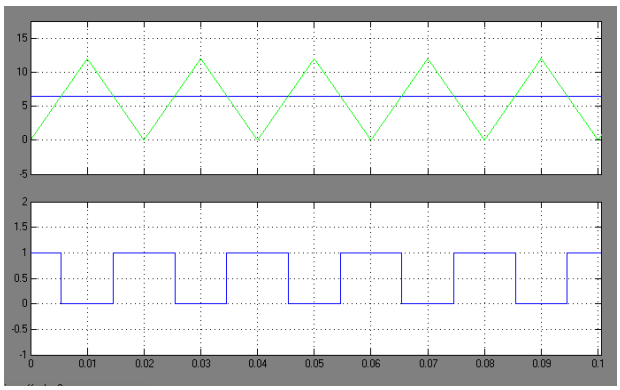

Fig. 2: Single Pwm Generation Method and Pulse Pattern

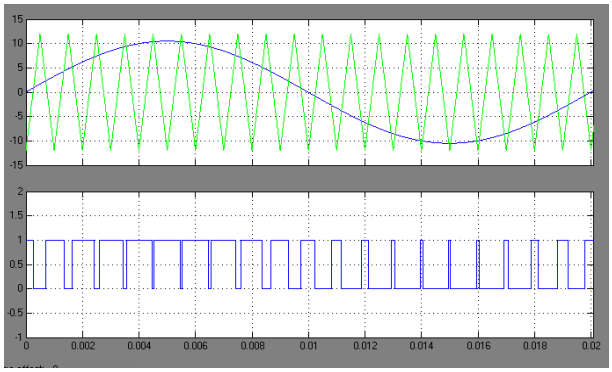

Fig. 3: Sine Pwm Generation Method and Pulse Pattern

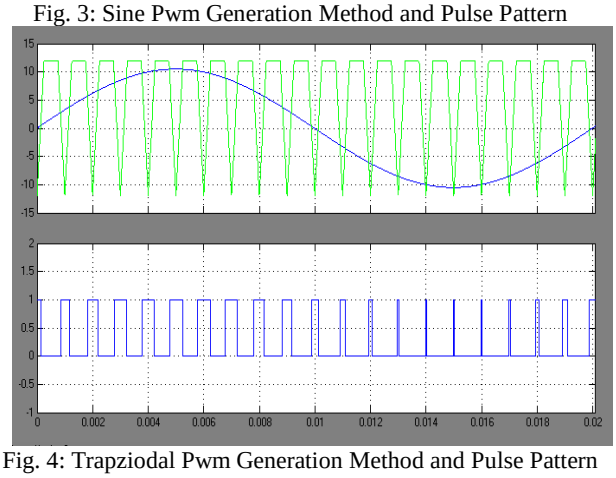

Fig. 4: Trapziodal Pwm Generation Method and Pulse Pattern

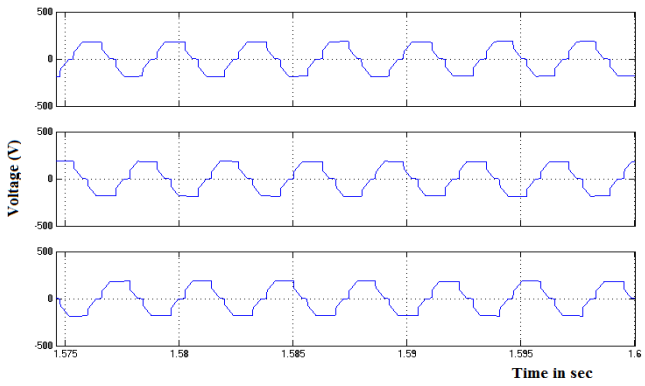

Fig.5: Wind generator output voltages

IV. SIMULATION AND DISCUSSION

Fig.5 shows the wind generated output voltage wave form this voltage giving to rectifier and converted into DC. This DC supply is given to switched inductor based QZSI impedance source inverter. It converts DC-AC with voltage boosting. This AC voltage drives the induction motor. Figure 6 shows the inverter output current using single pulse technique. Figure 7 shows the rotor speed in RPM.

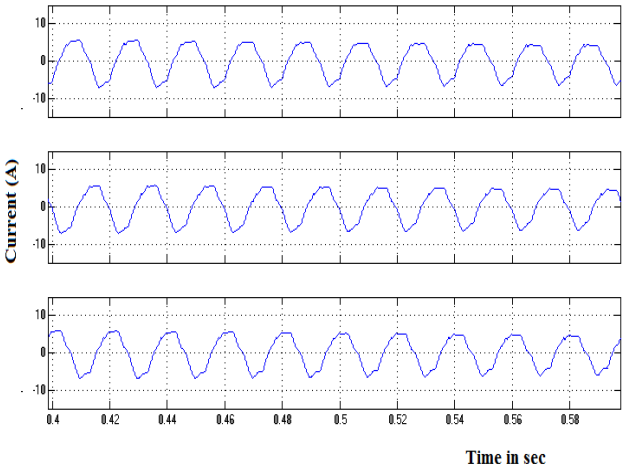

Fig. 6: Inverter output current

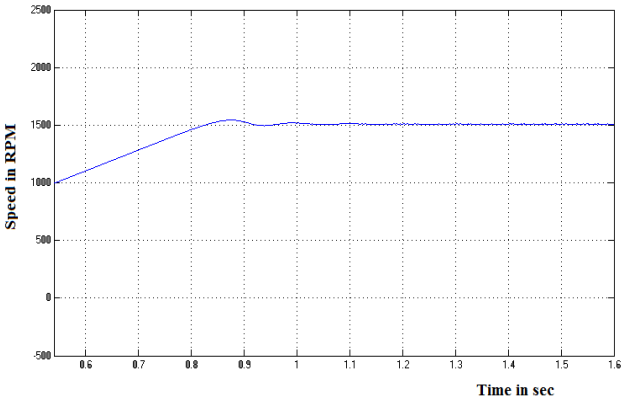

Fig. 7: Rotor speed in RPM

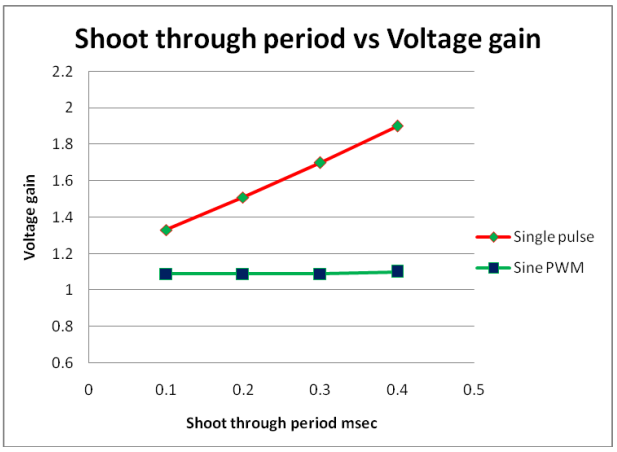

Fig. 8: graphs between voltage gain and shoot through period

V. COMPARATIVE ANALYSIS:

Fig. 8 and 9 shows the graph between voltage gain and shoot through period of the inverter. The single pulse PWM technique has better voltage gain compare than Sine PWM technique. It is shown that fig. 9. Fig. 10 shows the graph between harmonic and shoot through period of the inverter.

The Sine PWM technique has less harmonic compare than single pulse PWM technique. It is shown that from fig. 10. Trapezoidal PWM method has less harmonic compare than Sine PWM technique it is shown that fig. 11.

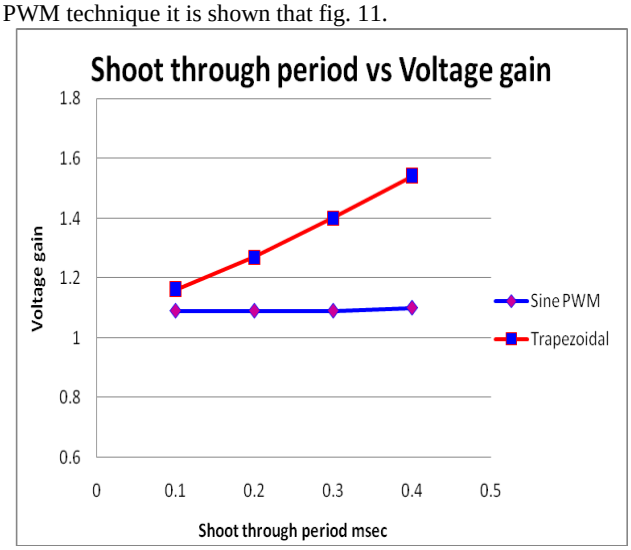

Fig. 9: graphs between voltage gain and shoot through period

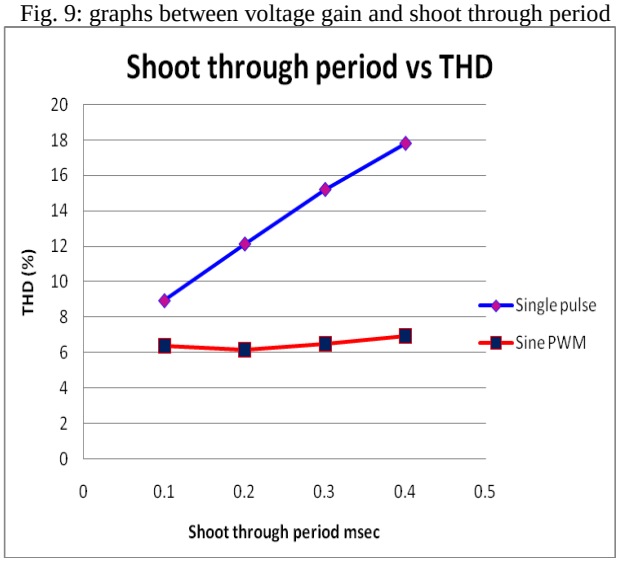

Fig. 10: graphs between harmonic and shoot through period

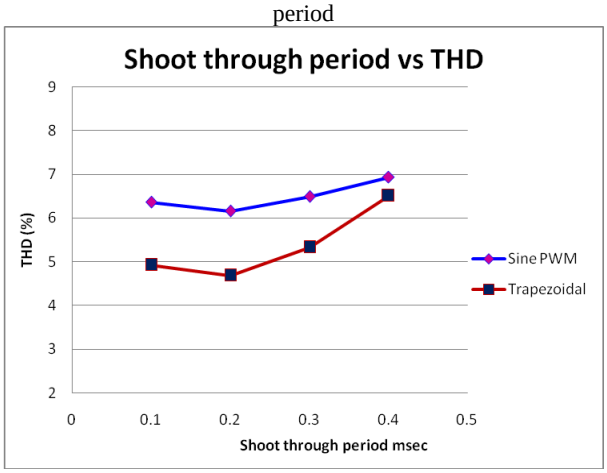

Fig. 11: graphs between harmonic and shoot through period

VI. CONCLUSION:

The proposed inverter is simulated using single pulse PWM, Sine PWM and Trapezoidal PWM method in this paper. The voltage gain is more in single pulse PWM technique compare than Sine PWM and Trapezoidal method. The Trapezoidal method has high voltage gain compare than Sine PWM method and less compare than single pulse PWM technique. The trapezoidal PWM technique has less harmonic compare than single pulse and Sine PWM method the Sine PWM has less harmonic compare than single pulse PWM technique and more than trapezoidal method. From this result the trapezoidal method has better voltage gain and less harmonic compare than other two techniques.

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