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Space Vector Modulation Control Based Induction Motor for Photovoltaic Application

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Abstract: The proposed study is based on the switched inductor quasi Z source inverter. The photovoltaic is the source of the proposed circuit and the SL QZSI fed induction motor. The speed of an induction motor is controlled by using the space vector modulation. The proposed converter is to increase the voltage and also to regulate the dc link voltage. The proposed SL QZSI has use the passive element in the main circuit which increases the voltage and reduces the voltage ripple. The single diode based photovoltaic has improved the reliability, efficient and reduce the voltage stress across the capacitor. The novel control method of proposed system is to generate more power in the output of the inverter. In order to filter the ripple and the proposed circuit implementation is verified by using MATLAB/Simulink.

Key words: Photo Voltaic (PV), Switched Inductor QZSI (SL-QZSI), Space Vector Modulation (SVM), Induction Motor (IM), voltage, circuit

INTRODUCTION

The solar based SL QZSI inverter has produced as much output compared to the conventional based inverter (Sadhwani and Ragavan, 2016). The single stage inverter is used in the proposed circuit method. The proposed inverter increases the voltage ratio and enhances the reliability of the system (Oliveira *et al*., 2015). In distributed generation application the low voltage source such as PV, fuel, etc. is used as the source. The SL-QZSI has combined with the boost inverter will reduce the voltage ripple and to increase the efficiency of the network (Magzoub *et al*., 2014; Akkarapaka and Singh, 2014).

The single diode based PV Model is used because it has less cost, easy maintenance and noise less power production (Zahraoui *et al*., 2015). A novel PV Model has small error for various kinds of PV cell types for evaluation. The dynamic modeling of PV based SL-QZSIs has more efficient operation.

The induction motor is connected in the switched inductor q impedance source inverter. The motor has drawn more power compared to the other conventional motor. The proposed inverter produces high power and fed into the three phase induction motor (Kumar and Ramesh, 2015). The motor performance is improved by using the space vector modulation control. In this study described that the PV inverter topology it is a high efficiency topology (Bavitra *et al*., 2015). Firefly algorithm is presented in this study in this algorithm used to generate the reactive power (Kannan *et al*., 2015).

MATERIALS AND METHODS

Switched inductor quasi Z source inverter: The switched inductor quasi ZSI has reduced the problem of conventional converter. The proposed inverter attains the high rating of voltage in the output of the inverter. The value of inductor and capacitor will be reduced is compared to the QZSI, ZSI. The proposed inverter attains high power by using the renewable energy sources. The switched inductor quasi ZSI is shown in Fig. 1. The boost factor of SL-QZSI has:

$$B = \frac{1+D}{1-2D-D^2} \quad (1)$$

By increasing the voltage gain of the proposed inverter to increase the duty ratio D_0 and modulation index M:

$$M \leq 1-D_0 \quad (2)$$

Proposed circuit method: The block diagram of proposed method is shown in Fig. 2. The photovoltaic power generation is used as the source of the proposed method. The PV based dc power is fed into the switched inductor quasi impedance source network. This inverter generates high gain with less passive elements. The single stage

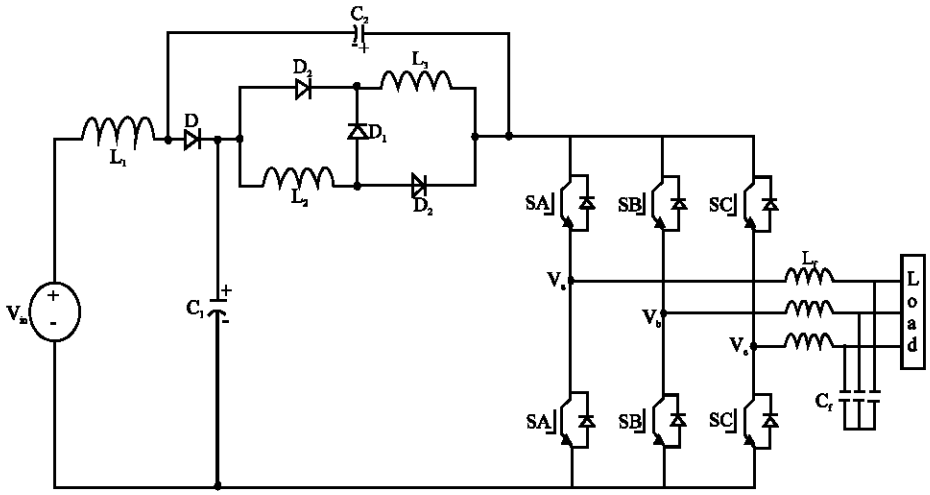

Fig. 1: Switched inductor quasi ZSI

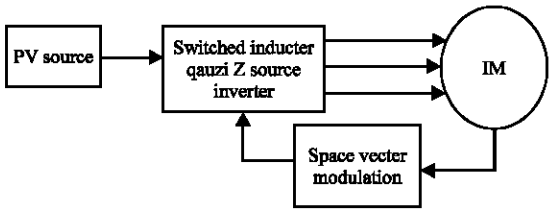

Fig. 2: Block diagram of proposed method

power converter is used and the output is used to run the induction motor. The space vector modulation is used to control the stator voltage and speed control of an induction motor.

RESULTS AND DISCUSSION

The advantages of proposed SL-QZSI are compared to the convention inverter. The control strategy of proposed method is space vector modulation. This SVM is to regulate the speed of an induction motor. The space vector is the advanced method of PWM technique. To produce the less harmonic content of voltage and current in the inverter circuit this method is used. In three phase eight possible combinations of on and off states. The two zero vector and six non-zero vector. The upper three switches on and the lower three switches off. These two combinations is the zero vector of SPM. The photovoltaic based switched inductor impedance network for increasing the output power and fed into the induction motor.

The output of the PV voltage and current is shown in Fig 3. The dc link voltage of the proposed circuit is shown in Fig. 4. The three phase output inverter is shown in Fig. 5. The speed of an induction motor is shown in Fig. 6.

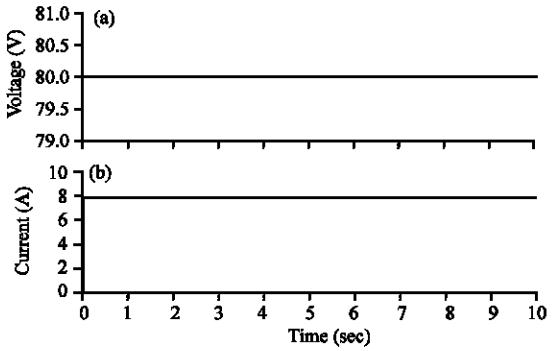

Fig. 3: PV voltage and current

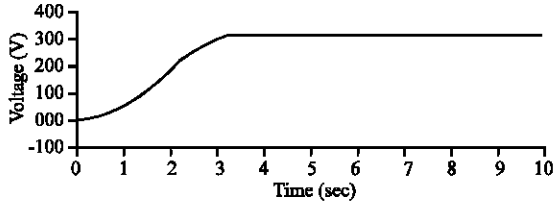

Fig. 4: DC Link capacitor across voltage waveform

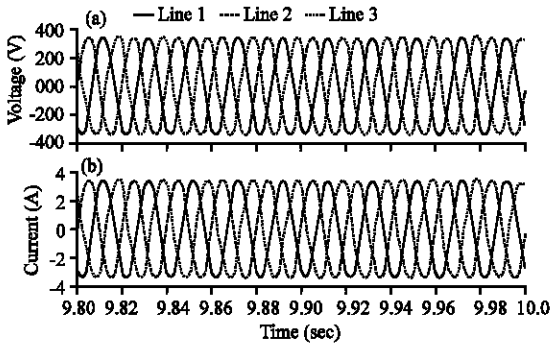

Fig. 5: Three phase voltage and current waveform

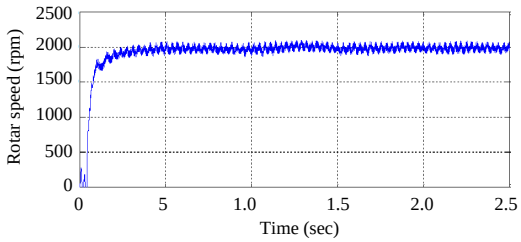

Fig. 6: Speed of an induction motor

CONCLUSION

The three phase induction motor functioning is increased and the dc voltage is improved. The proposed SVM based motor has reduce the passive element and also reduce the total harmonic distortion. The distribution system based SL-QZSI has increases the voltage gain and the simulation is verified.

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