Impedance Supply Inverter for Adjustable Speed Drives

G.Uvaraj
Research Scholar
Department of Electrical and Electronics Engineering
SCSVMV University,Enathur,Kanchipura,Tamilnadu,India

B.Kandavel
Research Scholar
Department of Electrical and Electronics Engineering
SCSVMV University,Enathur,Kanchipuram,Tamilnadu,India

Dr.M.Manikandan
Associate Professor
Department of Electronics and Communication Engineering
Anna University,Chennai,Tamilnadu,India

Abstract- This paper presents the simulation of mutual inductor primarily based impedance supply inverter (ZSI) for adjustable speed drives for stable operation by changing the hardware conciliation using discontinuous PWM strategy. The proposed inverter has an impedance network, this providing unique options that can't be obtained in traditional VSI and CSI. By controlling the shoot-through duty cycle ratio, the ZSI system provides ride through capability, reduces line harmonics, improves power factor, provides reliable operation and extends output voltage range. The ZSI using IGBT reduces the voltage stress across the switches. The analysis and simulation results will be presented to demonstrate these new options.
Index Terms: Mutual inductor, impedance source inverter, change speed drives

I. INTRODUCTION

The ancient general-purpose ASD system is predicated on VSI and CSI, which encompass diode rectifier,DC-link and Inverter Bridge.   The figure.1 shows the VSI, that consists of capacitor as DC-link. As a result of of the VSI the ASD system suffers the following common limitations and issues.
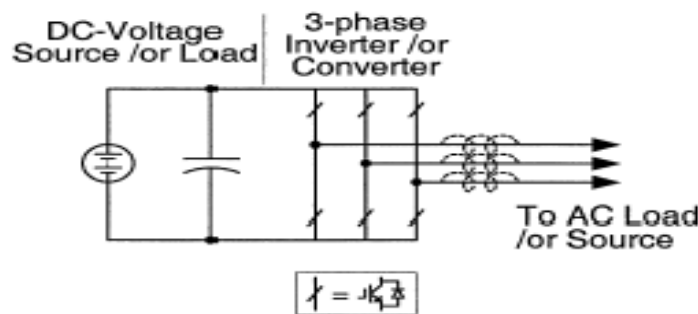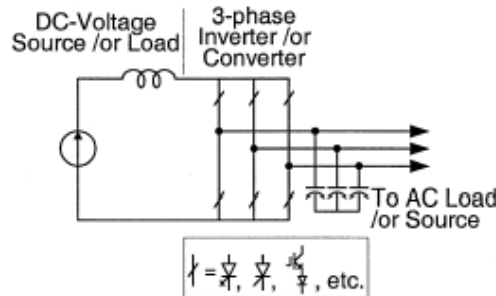

Figure-1. Voltage Source Inverter(VSI)

- The obtainable output voltage is limited quite below the input line voltage. Therefore the VSI is known as buck inverter.
- Inrush and the harmonic current from the diode rectifier can pollute the line. Low power factor is another issue of the traditional ASD system.

- Gating on the both devices in an exceedingly leg simultaneously, could leads to the shoot-through problem by EMI noises. This results in major killer to converters reliability.

The Fig.-2 shows the traditional three section CSI. The massive DC inductor provides the DC-link for CSI. The CSI has the following conceptual and theoretical barriers and limitations.

A.   Figure 2 Current source inverter

- The AC output voltage has got to be larger than the first DC voltage that feeds the inductor.
- At least one in every of the upper devices and one in every of the lower devices must be gated on and maintained on at any time. otherwise an open circuit of DC inductor would occur and destroy the devices.

II. Z SOURCE INVERTER

The proposed (Impedance supply) inverter employs a unique impedance network (or circuit) to couple the inverter main circuit to the power supply, thus providing distinctive features that can't be obtained within the traditional voltage-source and current-source inverters where a capacitor and inductor are used, respectively. The Z-supply inverter overcomes the conceptual and theoretical barriers and limitations of the traditional voltage-source inverter and current-source inverter. By controlling the shoot-through duty cycle, the Z-supply will turn out any desired output ac voltage, even bigger than the line voltage. The Fig.-3 shows the block diagram of ZSI.
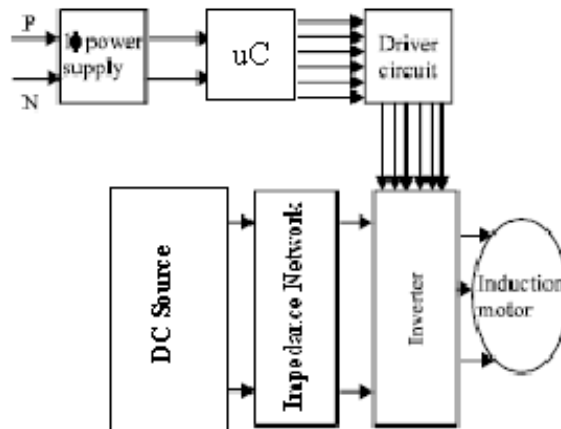

Figure 3. Block diagram of ZSI

The ZSI consist of rectifier unit, impedance network, Inverter Bridge, and gate driver circuits. The gating signals are generated from the micro controller unit.
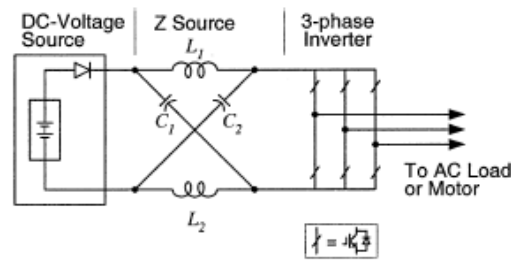
Figure-4. Impedance Source Inverter

The figure-4 shows the Z-source inverter. The impedance network consists of 2 equal inductors and capacitors connected in series and diagonal arms respectively.

The maximum constant boost control methodology is employed in this proposed inverter. This results in the reduction of volume and price by keeping the shoot duty ratio constant. The discontinuous PWM can minimize the harmonic content, this signal feed to IGBT gate terminal, depending upon the gating signal of the inverter operates.

III. PROPOSED SCHEME

The proposed theme extends the Z supply with one mutual inductor and one capacitor. The new network that is shown in fig.5 operates like the present principle with non-shoot through and shoot through states. Within the non shoot through state L1, L2 and C are connected in such a fashion as shown in Fig.5 and C is charged, while mutual inductor transfer energy from dc source to the main circuit. Within the shoot through state the inverter aspect is shorted by shorting any section leg. Throughout this state mutual inductor stores the energy and capacitor is discharged.

IV. SIMULATION

Simulations are performed to evolve the on top of analysis. The fig-5 shows the circuit configuration of proposed inverter and additionally shows the simulation waveform when the availability voltage V=150V and therefore the impedance network parameters are L1=L2=3mH and C =1600uF. The purpose of the system is to run the asynchronous drive for stable operation using renewable energy sources. The output voltage and current waveforms are shown in Figure. 6 (a)&(b) In this case the desired output for ac drive applications will be obtained results when Vdc=150V, M=0.85, Vout=400V.
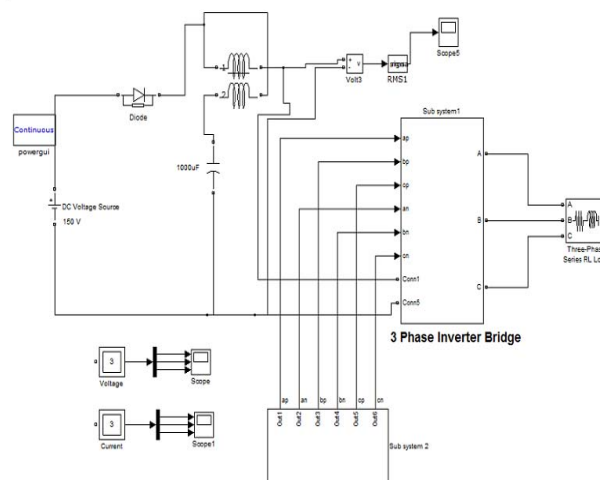

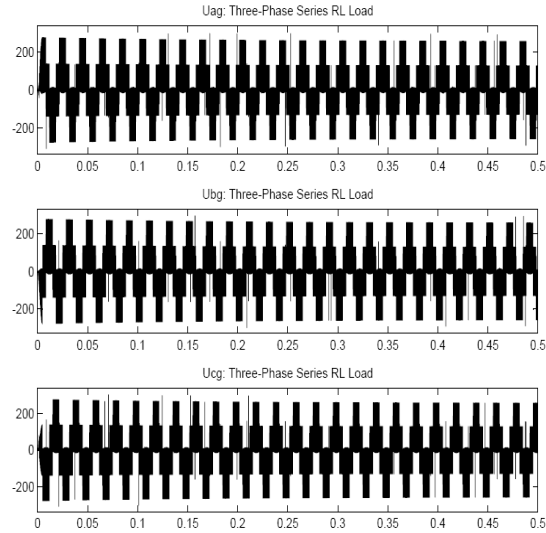Fig. 5 Proposed circuit diagram of Mutual inductor z supply inverter
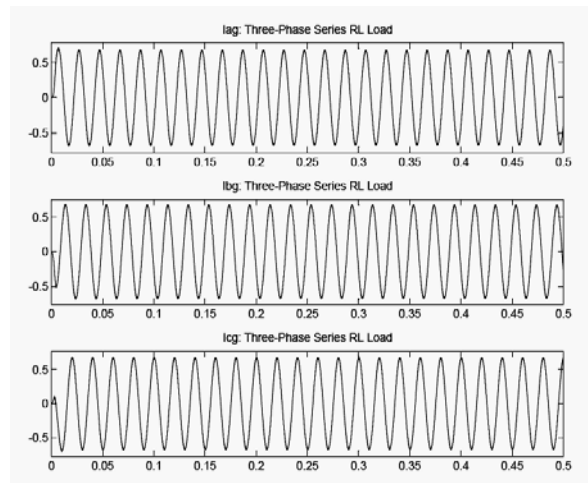
Figure.6(a) Voltage Waveform

Figure.6 (b). Current Waveform

IV. CONCLUSION

This paper has presented a Z-supply power converter for implementing DC-AC & AC-AC power conversions. Simulation results verified the operation and demonstrated the promising features. In outline the mutual inductor based mostly ZSI system has several distinctive advantages that are very fascinating for several ASD applications. It will turn out any desired output voltage even greater than the rated voltage.

REFERENCES

[1] Z- Source inverter presented by FANG ZHENG PENG, IEEE Transactions on Industry applications, vol.39.no.2, March/April 2003.
[2] Z- Source Inverter for Adjustable Speed Drives by Fang Z. Peng, Xiaoming Yuan, Xupeng Fang, and Zhaoming Qian, IEEE Power Electronics Letters, vol. 1, no.2, June 2003.
[3] Maximum Boost control of the Z Source inverter by Fang Z. Peng, Zhaoming Qian, IEEE Transactions on Power Electronics, vol.20, no.4, July 2005.
[4] An improved Z Source Inverter by Yu Tang, Shaojun Xie, and Chaohua Zhang, IEEE Trans. Pow.Elec, vol. 26, no. 12, pp. 3865-3868, Dec 2011.
[5] Voltage and current-programmed modes in control of the Z-source converter by G. Sen and M. E. Elbuluk, IEEE Trans. Ind. Appl., vol. 46, no. 2, pp. 680-V686, Mar./Apr. 2010.

[6]   Steady-state analysis and designing impedance network of Z-source inverters by S. Rajakaruna and L. Jayawickrama , IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2483-V2491, Jul. 2010.

[7]   Z-source inverter for motor drives by F. Z. Peng, A. Joseph, J.Wang, M. Shen, L. Chen, Z. Pan, E. Ortiz-Rivera, and Y. Huang,IEEE Trans. Power Electron., vol. 20, no. 4, pp. 857-V863, Jul. 2005.

[8]   Understanding the operation of a Z-source inverter for photovoltaic application with a design example by M. Hanif, M. Basu, and K. Gaughan, IET Power Electron., vol. 4, no. 3, pp. 278-V287, Mar. 2011.

[9]   Application of Z-source inverter for traction drive of fuel cell-XBattery hybrid electric vehicles by F. Z. Peng, M. Shen, and K. Holland,-¨ IEEE Trans. Power Electron., vol. 22, no. 3, pp. 1054-V1061, May 2007.