COMPARATIVE ANALYSIS OF L-Z SOURCE INVERTER AND VOLTAGE SOURCE INVERTER FOR DISTRIBUTED GENERATION SYSTEM

1K. Divya*, 1T. Gowtham Raj, 1S.K. Saranya, 2S. Amuthameena

1Department of Electrical and Electronics Engineering
2Department of Electronics and Instrumentation Engineering
M. Kamarasamy College of Engineering, Karur-639113, India.

*Corresponding author email id: divyak.eee@mkce.ac.in

ABSTRACT

These paper presents mainly on the basis of Comparative Analysis of L-Z source inverter and voltage source inverter. In distributed generation system the harmonics can be reduced by using power electronic semiconductor switches. The voltage source inverter and L-Z source inverter and voltage source inverter are placed between solar photovoltaic panel and grid. Additional of inductance and capacitance in the inverter makes use of reducing the harmonics and it makes to increase the input voltage. The grid side not all the power converters has been used to reduce the harmonics for also the distributed generation system. For the high power analysis we cannot use the normal DC-DC converter has been used for that we need special function for distributed generating system connected with grid. For that, the proposed system makes that comparing the L-Z-source inverter and voltage inverter one converter will be suited based on the performance. The quality of the grid should be improved by that reducing the harmonics by the inverter. The result of the proposed system is obtained by using the MATLAB SIMULINK software.

Index Terms—THD, L-Z- source inverter, voltage source inverter, Distributed generating system, Grid.

1. INTRODUCTION

In recent days the Distributed Generation (DG) is more important to getting more efficient power transfer. The highly used Distribution Generation systems are solar panels, wind mills, thermal power plant. In general, the energy get from these resources are connected by the inverter and to the grid and the inverters are mainly used for carrying the active and reactive power to the transmission. The drawbacks are it can inject or it will absorb the reactive power in some cases and most of the systems are operate unity power factor [1][2]. The another drawback of the distribution generation system is the power will not continuously go to the grid because of some factors like the lack of power demand and consumption will be more. In these cases the inverter places the major role to get more efficiency by reducing the harmonics and giving to grid [3][4].

To get the maximum power the tracking is important in a PV array and it is vital part of a PV system. Now many Maximum power point techniques had been implemented and executed. The techniques had been vary in design, availability of sensors, cost, high speed, popularity, the length of effectiveness, hardware implementation on real time application and in other expects [5][6]. The range of the panel should be the most resourceful. The number of
methods had been implemented in that more methods are become tough to apply for getting maximum power, the proposed system will be is more suitable for the PV module. The paper based on solar Photo Voltaic cell with MPPT has grown significantly of the last decades and remains strong. In the distribution level the economical based system is not applicable because the supportive services are not provided frequently [7][8]. The L-Z source inverter has been the introduced to make efficient in the power converter side DG system and these partially different from the conventional Voltage source inverter.

The L-Z Source inverter has designed based on boosting the input voltage by the inductor and the diode, and it makes the common ground for the direct current source and the converter, by that it can avoid the drawbacks comes from the capacitors in the traditional Z-Source Inverter and the S-L-Z Source inverter, especially in deducting the inrush current at initializing and it can further reduce by resonance of Z-source capacitor and inductor [9][10]. For protecting the switching devices in voltage source inverter we want to avoid the shoot through. By that the total harmonics distortion can be reduced using the L- Z source inverter.

2. PROPOSED SYSTEM

The direct current as source is given to the inverter. The buck boost circuit is mainly used for the increase the voltage and it produces the inrush current at the output. The inverter side the input will be get by the buck boost converter and it converts to the ac supply. The pulse of the inverter is received by the pulse width modulation generator and the operation will perform [11][12]. The inverter output voltage is given to the non-linear load and then to the grid. The proposed system block diagram of the grid connected z-source inverter is shown in fig.1.

From the main circuit the buck boost DC voltage is produced and the inrush current will occur in the output, then thee DC input voltage is given to the main circuit. After that the three phase inverter is get supply from the converter. From the Pulse width Modulated Generator the pulses have been generated and it is given to the switches in three phase inverter. The purpose of using three phase inverter is converting fixed DC Voltage to the variable AC voltage [13][14]. Then the non linear load is fed the supply from three phase inverter output ac voltage. The block diagram of grid connected Z source inverter shown in Fig 1.
The proposed system uses two inductors and three diodes for boosting the input DC voltage and has no capacitor [15][16]. The system can suppress the resonance by removing capacitor to improve the efficiency of power supply and also it reduces the inrush current limitation at startup. In proposed paper L-Z-Source network was implemented [17].

3. CIRCUIT DESCRIPTION

3.1 L-Z-Source Network:
In the proposed system the inverter has three diodes (D1, D2, D3), it has no capacitor and it consists of two inductors (L1, L2) and its shown in the figure 2. The switched inductor cell has the combination of $L2-L3-D1-D2-D3$. In the proposed system it provides some inrush current, and in the initial condition no current will flow in the traditional circuits. The additional information that proposed system also makes the common ground for both the source and the inverter. The working modes for the L-Z source inverter are non shoot through mode and the shoot through mode [18][19]. The two modes of operation are explained as in the non shoot through mode the inductors are connected in parallel and its stores the energy, and in the shoot through mode the inductors are connected in series and its supplies the energy to the main circuit.
3.2 Operation Modes:
The L-Z Source Inverter has the operating principles of shoot through mode is six active states when its besides by zero states. The main reason of analysis is to operation states to be simplified by the two conditions that is shoot through state and non shoot through state.

Mode 1: Non-Shoot through state:

![Non-Shoot through mode.](image)

In the non-shoot-through state, as shown in Fig. 4, the uncontrolled $D_2$ is turned on, while the uncontrolled $D_1$ and $D_3$ will get turned OFF [20][21]. The inductance $L_1$ and $L_2$ will be connect in series and the $L_1$ and $L_2$ will transfer the energy from the dc supply to the main circuit, and the equivalent circuit is shown in Fig.4.

Mode 2: Shoot through state:

![Shoot through mode.](image)

The shoot-through state has shown in Fig. 3, the switching devices of inverter had been short circuited and we can take either upper or lower devices has been taken. When the condition is occur, the diode $D_2$ is turned off, in that condition the diode $D_1$ and $D_3$ will turned on. The inductance $L_1$ and $L_2$ are connected in the parallel wise [22][23].

Applying the volt–second balance principle to $L_1$ and $L_2$ Fig. 5 the corresponding voltages across $L_1$ and $L_2$ in this state are $V_{L1}$ and, $V_{L2}$ respectively. Where $V_{dc}$is the source and $V_i$ is the dc-link voltage [24][25].

4. SIMULATION RESULTS OF PROPOSED L-Z SOURCE INVERTER BASED DISTRIBUTION GENERATION SYSTEM

The proposed system results had been discussed by using MATLAB/SIMULINK software is shown below. The proposed system simulation diagram has shown in fig.6.
The existing systems simulation results had been shown below. The input voltage of Direct Current and Voltage for 50V has given in fig.7 and fig.8.

Fig.6- grid connected L-Z source inverter.

Fig 7. using Voltage Source Inverter grid current performance.

Fig 8. using Voltage Source Inverter the grid voltage performance.

Fig 9. using L-Z Source Inverter the grid current performance.
Fig 10. using L-Z Source Inverter the grid voltage performance.

Table 1. $V_{THD}$, $I_{THD}$ for different input voltages

<table>
<thead>
<tr>
<th>Parameters</th>
<th>L-Z source inverter</th>
<th>Voltage Source Inverter</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{THD}$</td>
<td>2.21</td>
<td>14.47</td>
</tr>
<tr>
<td>$I_{THD}$</td>
<td>0</td>
<td>1.36%</td>
</tr>
</tbody>
</table>

5. CONCLUSION
This paper represents the comparison of the L-Z Source Inverter and voltage source inverter connected with grid. That comparing these two converters the suitable converter has been identified for the Distribution Generation system and the power quality has also been improved. In that the L-Z-source inverter fed controllable Distribution Generation system is better than the voltage source inverter fed grid. The switching and sequence and the low pass
filter it can reduce the harmonics and the quality should be improved. Thus the performances and analysis is done then the result will be verified by using the MATLAB/SIMULINK software. From the analysis the harmonics has been reduced and L-Z source inverter is better than VSI.

REFERENCES


