A Comparison of 5 Level Multilevel Inverter Topologies

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Abstract: Nowadays, multilevel inverters are required for high power applications. The multilevel inverters are not only achieve high power ratings, but also use the renewable energy sources. Renewable energy sources like photovoltaic, wind and fuel cells can easily used to supply to inverter system. This paper deals with the comparative study of other topology of multilevel inverter and traditional multilevel inverter basically cascaded H-bridge inverter topology. The proposed topology reduced the number of switches and THD compare to the traditional multilevel inverter.

Keywords: Cascaded H-bridge inverter, Total Harmonic Distortion

1. Introduction

Power electronic inverters are widely used in various industrial drive applications. To overcome the problems of the limited voltage and current ratings of power semiconductors devices, some kinds of series and/or parallel connections are necessary [1]. Now days, the multilevel inverters have received more attention due to their ability to synthesize waveforms with a better harmonic spectrum and to attain higher voltages. The most popular topologies for multilevel inverters are neutral-point clamped (NPC) inverters and cascaded H-bridge inverters. The traditional three-level NPC inverter is simple in structure, but can only be used in the medium voltage drives because of the limited voltage of the semiconductor devices. The inverter output voltage required an LC output filter to smooth output voltage which is heavy and expensive. So that in most high-voltage industrial drives the cascaded H-bridge inverters are used which typically consists of five or more H-bridge cells per phase. This topology presents excellent input-current and output-voltage waveform, however, suffers from some drawbacks: the big number of components for the rectifier and inverter, as well as the complexity of the control and input transformer. Furthermore, it's very difficult to operate at 4 quadrants with energy recuperation. All these have negative impacts on the efficiency and cause a higher cost of the drives.

2. System Overview

This paper proposes the comparison of different topologies of cascaded multilevel inverters. A traditional 5-level cascaded multilevel inverter utilizes 8 switches. The other multilevel inverter topology also produces 5-level with 5 switches. A traditional 5-level inverter required 2 battery sources. The other multilevel inverter topology also required same number of battery sources which is used in traditional 5-level multilevel inverter.
3. Simulation Results

The simulation model was designed using MATLAB / Simulink Software. The gating signals for the inverter are generated by using multicarrier pulse width modulation technique

![MATLAB simulation circuit diagram for Circuit for 5 level other multilevel inverter topology](image1)

![Gate pulses of 5-level other multilevel inverter topology](image2)

![Output voltage of 5-level other multilevel inverter topology](image3)

![5-level other multilevel inverter topology with multicarrier modulation THD=26.20%](image4)

4. Conclusion

Comparing the result of different topologies prove that topology of fig 2 is better as it gives nearly same output with reduce number of switches

<table>
<thead>
<tr>
<th>Multilevel inverter</th>
<th>Number of battery source</th>
<th>Number of switches</th>
<th>THD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-level cascaded multilevel inverter</td>
<td>2</td>
<td>8</td>
<td>26.64%</td>
</tr>
<tr>
<td>5-level other multilevel inverter</td>
<td>2</td>
<td>5</td>
<td>26.20%</td>
</tr>
</tbody>
</table>

References


