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A Fifteen Levels Inverter with A Lower Number of Devices and Higher Performance

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Abstract
Multi-level inverters, as a result of the significant contributions they have made to the fields of high voltage and renewable energy applications, MLI has earned a prestigious place in the field of industrial electronics applications. The use of MLI makes it possible to generate an alternating voltage from a DC voltage or from voltages that are continuously applied thanks to this capability. The quality of the produced wave depends on minimizing the level of total harmonic distortion (THD) in the ensuing output voltage. Increasing the total number of levels is required in order to bring down the THD. The bigger the number of layers, the lower the THD. On the other hand, this necessitates an increase in the number of power switches that are utilized, in addition to an increase in the number of DC sources for certain types. A greater number of levels are achieved in this work with a reduced number of switches, and the DC source necessitates the use of specialized control over the switches as well as the grading of the DC source values. In order to demonstrate that the suggested converter achieves the needed outcomes, the MATLAB simulator is utilized.

KEYWORDS: Inverter, Multi-level inverters, THD reduction, SPWM.

I. INTRODUCTION

Multilevel inverters are commonly used today because of their voltage operation and functional versatility. The output is generated by a multilayer inverter, which draws power from many DC sources. With an increasing number of DC sources and a constant switching frequency, the inverter's voltage output waveform can be made to seem almost sinusoidal [1]-[4].

The optimal performance of the vast majority of electrical applications can be ensured by utilizing a supply that generates a sinusoidal waveform. The output voltage gets closer to having the shape of a sinusoidal wave as the number of inverter levels gets higher, which results in a decrease in the amount of total harmonic distortion (THD).

The multi-level inverter has a number of advantages over the hard-switched, two-level pulse width modulation (PWM) inverter. These benefits include a decreased dv/dt during high power operations as well as an increase in efficiency [5]-[8].

Three main types of topologies are used for multi-level inverters: cascade, diode clamp, and capacitor clamp. Cascade is the most common topology. The following topologies are included in this category: The cascade multi-level inverter is the one that requires the least amount of work to put together and has the fewest number of individual parts.

Most of the time, a cascade MLI is built using a series of DC sources and switches that are sequentially connected to one another [9]-[11].

To get the fundamental voltage and get rid of the higher-order harmonics in the output, the switches have to be turned on and off repeatedly so that alternating current voltage can be generated with several levels. This is necessary to accomplish [12].

Several DC sources contribute to its reduced switching losses and stress on the voltage supply. Multilevel inverters continue to be implemented in a growing number of facilities because of their low EMI output, high efficiency, and low switching losses in addition to their high voltage operation capacity.

Multiple levels are represented by the inverter's first three settings [13]. Multilevel inverters are becoming more common in power electronic applications as a result of the higher requirements for power quality and power rating