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A REVIEW OF SELECTIVE HARMONIC ELIMINATION TECHNIQUE BASED DIFFERENT OPTIMIZATION TECHNIQUES

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ABSTRACT

The review of multilevel inverter utilization has been increased since the last decade. These new type of inverters are suitable in various high voltage and high power applications due to their ability to synthesize waveforms with better harmonic spectrum and faithful output. In this paper we study various methodologies for Selective harmonic elimination, PSO, and Genetic algorithm. Due to its higher quality solution including mathematical simplicity, fast convergence & robustness it has become popular for many optimization problems. This paper presents a review application of PSO for harmonic reduction in Multilevel inverters.

KEYWORDS: Selective harmonic elimination (SHE), Cascaded multilevel inverter, Particle swarm optimization (PSO), GA, etc.

INTRODUCTION

Multilevel power conversion has become increasingly popular in recent years due to advantages of high power quality waveforms, low electromagnetic compatibility (EMC) concerns, low switching losses, and high-voltage capability. However, it increases the number of switching devices and other components, which results in an increase of complexity problems and system cost. There are different types of multilevel circuits involved. The first topology introduced was the series H-bridge design. This was followed by the diode clamped converter, which utilized a bank of series capacitors. A later invention detailed the flying capacitor design in which the capacitors were floating rather than series-connected. Another multilevel design involves parallel connection of inverter phases through inter-phase reactors. In this design, the semiconductors block the entire dc voltage, but share the load current.

The key issue in designing an effective multilevel inverter is to ensure that the total harmonic distortion (THD) of the output voltage waveform is within acceptable limits. Basically, there are four types of control methods for multilevel converters. They are the fundamental frequency switching method, space vector control method, traditional PWM control method and space vector PWM method .The fundamental frequency switching and space vector control methods have the benefit of low switching frequency, although they have high low-order harmonics at low modulation indices as compared to the other two control methods. Generally, the traditional PWM method is widely used for harmonic elimination. But PWM techniques are not able to eliminate low-order harmonics completely. Another approach is to choose switching angles so that specific lower order dominant harmonics are suppressed.

Cascades H-bridge Multilevel Inverter

A cascade multilevel inverter is a power electronic device built to synthesize a desired AC voltage from several levels of DC voltages. Such inverters have been the subject of research in the last several years ("1")("2")("3")("4")("5"), where the DC levels were considered to be identical in that all of them were either batteries, solar cells, etc. In ("6"), a multilevel converter was presented in which the two separate DC sources were the secondaries of two transformers coupled to the utility AC power. In contrast, in this paper, only one source is used without the use of transformers. The interest here is interfacing a single DC power source with a cascade multilevel inverter where the other DC sources are capacitors. Currently, each phase of a cascade multilevel inverter requires n DC sources for 2n+1 level in applications that involve real power transfer. In this paper, a scheme is proposed that allows the use of a single DC power source (e.g., battery or fuel cell stack) with the remaining n−1 DC sources being capacitors. It is shown that one can simultaneously maintain the DC voltage level of the capacitors and choose a fundamental frequency switching pattern to produce a nearly sinusoidal output. To operate a cascade multilevel inverter using a single DC source, it is proposed to use capacitors as the DC sources for all but the first source. Consider a simple cascade multilevel inverter with two H-bridges as shown in Figure 1.

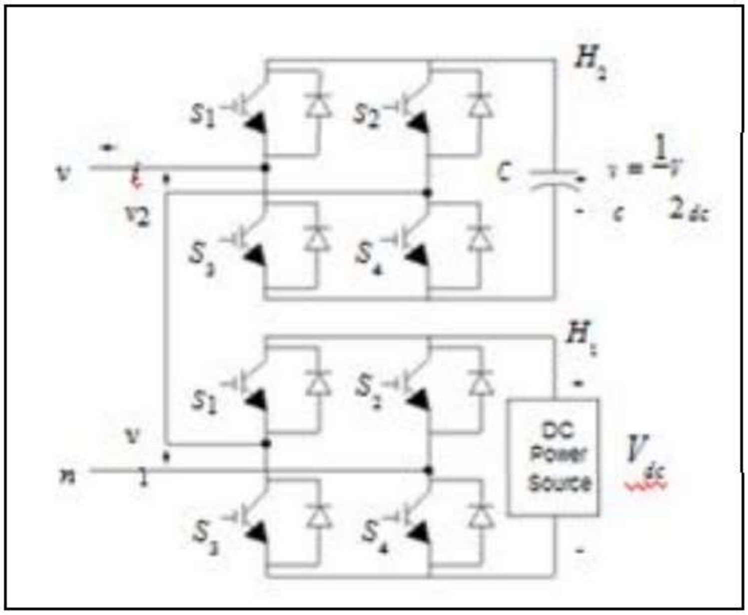

Fig. 1 Single-phase structure of a multilevel cascaded H-bridges inverter

LITERATURE REVIEW

The many researchers have been done significant work in the field of Selective Harmonic Elimination Technique Based different optimization Techniques problem some of the work is described in this paper.

ZHANG Wenyi, et.al, [1], done study in this paper, Selective Harmonic Elimination Technique based on Genetic Algorithm (GA), which can be arbitrary for the choice of initial value, make up for the deficiency of the Newton iterative algorithm, there is no need predict the tendency of switch angles in the entire modulation range in advance. Load can be better inhibition for selective harmonic elimination method based on GA, the size of the load will affect the output waveform of the inverter, and cause the increased harmonic content. Increasing the number of switching angle can reduce the harmonic content of the output current and total harmonic distortion. In this paper study of three-phase asynchronous motor, once again confirms the significance of genetic algorithm in the practical application.

T.JEEVABHARATHI, et.al, [2], investigate in this paper, elimination of harmonics in a Cascaded Multilevel Inverter technique by considering the non-equality of separated dc sources by using PSO is presented. The solving a nonlinear transcendental equation set describing the harmonic elimination problem with non-equal dc sources reaches the limitation of contemporary computer algebra software tools using the resultant method. In this paper using PSO optimization technique has been proposed to solve the Selective Harmonic Elimination problem with non-equal dc sources in H-bridge cascaded multilevel inverters. Approach reaches the limitation of contemporary algebra software tools, method is able to find the optimum switching angles in a simple manner.

Faete Filho, et.al, [3],in this paper, Real-Time Selective Harmonic Minimization for Multilevel Inverters Connected to Solar Panels Using Artificial Neural Network technique, the selective harmonic elimination problem using ANN to generate the switching angles in an 11-level full-bridge cascade inverter. A nondeterministic method is used to solve the system for the angles and to obtain the data set for the Artificial Neural Network training powered by five varying dc input sources. The output angles returned by the Artificial Neural Network may not provide a satisfactory result, or harmonic elimination, at some points as it generalizes; however, a fast result can be obtained, and more angles can be easily added to provide a better output waveform. Parallel networks can be used to accomplish better performance also.

Mariusz Malinowski, [5], in this paper, the cascaded multilevel inverters synthesize a medium voltage output based on a series connection of power cells which use standard low voltage component configurations. Due to these features, the cascaded multilevel inverter has been recognized as an important alternative in the medium-voltage inverter market. This characteristic allows one to achieve high-quality output voltages and input currents and also outstanding availability due to their intrinsic component redundancy. In this paper presents a survey of different topologies, control strategies and modulation used by these inverters. The regenerative and advanced topologies are also discussed.

CONCLUSION

The Genetic algorithm has been proposed to solve theSelective Harmonic Minimizationproblem with equal and non equal dc source in H-bridge cascaded multilevel inverter. The proposed method is able to find the optimum switching angles in a simple manner. It also reduces both the computational burden and running time, and ensures the accuracy and quality of the calculated angles. The Genetic algorithm technique proved its effectiveness in finding optimal solutions in extremely short time for different values of the dc sources, where THD was taken as a performance index to examine the effectiveness of the solution.

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