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Reactive Power Control In Decentralized Hybrid Power System With Statcom

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ABSTRACT

To minimize the power demand and scarcity we have to improve the power extracting methods. Multilevel inverter is used to extract power from solar cells, fuel cells and batteries. It synthesizes the desired ac output waveform from several dc sources.

This paper presents a three phase hybrid multilevel inverter topology that uses thirteen level transistor clamped H-Bridge with minimum total harmonic distortion. To achieve a better voltage utilization and harmonics reduction, Multicarrier Phase Shift Pulse Width Modulation control technology is used. The analysis of output voltage harmonics and the total power losses converging the switching power losses are carried out and compared with the cascaded neutral point clamped and conventional H-Bridge inverters. A new method to balance the system voltage in each source is developed and tested. For the verifications it is tested on three phase application systems. From the results, the proposed inverter provides higher output quality with relatively less harmonics losses and THD as compared to the other conventional inverters

INTRODUCTION

Multilevel converters are mainly used to synthesis a required single or three-phase voltage waveform. The required multi-staircase output voltage is obtained by combining several balanced dc voltage sources. The most commonly used independent sources are Solar cells, fuel cells, batteries and ultra-capacitors. One important application of multilevel converters is mainly concentrated on medium and high-power conversion systems. Now a day, there exist three commercial topologies of multilevel voltage-source inverters: neutral point clamped (NPC) or diode clamped inverter, cascaded H-bridge (CHB), and flying capacitors (FCs). Among these three topologies, cascaded multilevel inverter reaches the higher output voltage and power levels and the higher reliability due to its modular topology. Diode-clamped multilevel converters are utilized in conventional high-power ac motor drive applications like conveyors, pumps, fans and mills.

NPC also plays a vital role in oil, gas, metals, power, and mining, and water, marine and chemical industries. In regenerative system also the NPC multilevel inverter is used in back to back configuration. Flying capacitor multilevel converters have been used in high bandwidth high-switching frequency applications such as medium-voltage traction drives. Finally, hybrid cascaded H-bridge multilevel converters have been applied where high power and power quality are essential, for example, static synchronous compensators active filter, reactive power compensation applications, uninterruptible power supplies, photovoltaic power conversion and magnetic resonance imaging. One of the growing applications for multilevel motor drives is electric and hybrid power transient.

For increasing voltage levels, the number of switches also will increase in number. Hence this leads to voltage stress and switching loss. For minimizing these losses we have to add filters, this process makes the circuit will become complex. By using the proposed topology, number of switches will reduce significantly and increase the efficiency of the system. In high power applications, the harmonic content of the output waveforms has to be reduced as much as possible in order to avoid distortion in the grid and it will reach the maximum energy efficiency. The first multilevel inverter was introduced in three level converters. A multilevel converter is a power electronic system using several levels of dc voltages as inputs to synthesize a desired output voltage; the converter output voltage waveform approaches a nearly sinusoidal waveform while using a fundamental frequency-switching scheme.

A number of technical papers using selective harmonic elimination (SHE) or minimization have been reported for fundamental frequency operation using the most common multilevel (ML) inverter topologies. The cascade ML configuration has independent dc sources that may have different voltage levels. Those dc sources might be capacitors, fuel cells, or solar panels and will consequently bring a voltage imbalance depending on the system dynamics. Numerous papers have been reported using SHE or selective harmonic minimization of cascaded ML inverters.

EXISTING SYSTEM:

In addition to the better output quality, with more output levels, the possibility of insulation failure is reduced across the motor terminals compared to the

conventional CHB with similar configuration. It mainly focus on the constant speed drive applications such as fans, blowers, pumps and compressors, since these comprise 97% of currently installed medium voltage drives. The proposed method mainly reduced the components used and concentrates on the better voltage utilization. It also reduces the switch counts, total harmonic distortion and reduces the losses.

PROPOSED SYSTEM

A new decentralized robust strategy to improve small and large-signal stability and power-sharing of hybrid AC/DC micro-grids and improve its performance for nonlinear and unbalanced loads. In addition to the sliding mode controller for DC/DC converters, for the sake of improving power sharing and regulating active and reactive powers injected by distributed energy resources, and moreover, controlling harmonic and negative-sequence current in the presence of nonlinear and unbalanced loads, two separate controllers for positive sequence power control and negative sequence current control are designed based on the sliding mode control and Lyapunov function theory, respectively.

The primary advantage of multilevel inverter is their small output voltage, results in higher output quality, lower harmonic component, lower switching losses and better electromagnetic computability. The transistor clamped converter topology has received increased attention as it provides a simpler approach to increase output levels by taking different voltage levels from the series stacked capacitors. In this paper, the proposed new configuration uses a thirteen level transistor-clamped H-bridge (TCHB) that can produce a thirteen-level output instead of five-level as with the conventional H-bridge. A similar arrangement using a NPC in each power cell has been presented. However, for the efficient output an excessive number of power switches and diodes are required. Cascaded hybrid H-bridge multilevel inverters increases the voltage levels, reduce losses and used for industrial application.

CONCLUSION

In this paper, multilevel inverter configuration based on a thirteen-level TCHB inverter with multicarrier phase shifted PWM modulation technology, is analyzed and presented. A new method hybrid cascaded multilevel inverter was developed and tested with balanced DC source for better voltage utilization. The output voltages of the proposed inverter were analyzed in various operating

conditions. Detailed comparisons between the proposed inverter, NPC, 5LCHB and 9L-CHB in terms of power quality, power losses and total harmonic distortions also analyzed. From the observations, the proposed inverter is found potential not only for medium-voltage drive application but also other applications like high voltage drives demanding higher output quality. A control strategy was proposed based on SMC/LF-based controllers for a hybrid AC/DC WG/PV/FC micro-grid including nonlinear and unbalanced loads.

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