A MODULATION TECHNIQUE TO IMPROVE GRID VOLTAGE BY USING STATCOM UNDER CASCADED H-BRIDGE MULTILEVEL INVERTER

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ABSTRACT:

The modulated technique created for the balanced system allows Cascaded H-bridge Multilevel Inverter (MLI) to produce balanced voltage even when the grid voltage is unbalanced. The device over current in this scenario may be caused by the grid voltage's negative sequence component. Here, the grid voltage is split into its positive and negative phases first, and the STATCOM output voltage is likewise managed separately. However, there has not been a thorough investigation into how to calculate and synchronise the positive and negative sequence voltage. This work establishes a quantitative correlation between the positive and negative sequence voltages from the standpoint of power balancing. Additionally, it obtains the quantitative link between the positive modulation ratios. In this paper a cascaded multilevel inverter creates high voltage using several power electronic switches. Each h-bridge inverter produces different section of output waveforms. In order to produce a high voltage waveform, the output of the h-bridge is combined. The harmonic distortion of the waveform can be reduced by using several voltage levels, which also minimises the amount of electrical interference that is introduced in power system. Overall combining a STATCOM with a cascaded inverter offers a very effective and efficient method of compensating reactive power in systems. More flexibility in adjusting the output waveform to satisfy the unique needs of the power system is also made possible using different voltage levels. Simulation results show that proposed method is correct and effective.

KEYWORDS:

VOLTAGE STABILITY, STATCOM, MULTILEVEL INVERTER, GRID, HARMONICS, H-BRIDGE.

INTRODUCTION

The control of cascaded H-bridge STATCOM (static synchronous compensator) should be implemented as soon as possible. Respond to the reactive power requirement of the load while guaranteeing the device's safe and steady functioning. Especially when used on the public power grid, the device must be able to endure the effects of power system failures, maintain stable operation throughout grid recovery, and offer timely and effective dynamic reactive power assistance. If the STATCOM exclusively controls positive voltages, the negative sequence voltage of the grid may cause the device to overheat [1,2]. When a significant asymmetrical fault develops in a power grid, the system voltage decreases fast, and without matching regulation, the output current of the STATCOM exceeds the device's withstanding current capability [3,4]. The majority of cascaded STATCOM control schemes, such as typical current decoupling control, model predictive control, decoupled P-Q control, non-linear control, are well-designed based on a three-phase symmetric power system. However, numerous disturbances such as lightning, operating overvoltage, asymmetrical short-circuit fault, and asymmetric load will cause grid voltage asymmetry, affecting STATCOM's regular operation. If there is no effective management for the asymmetric operating circumstances, the device would create unbalanced and distorted currents, increasing system loss and decreasing running performance [5,6]. In serious cases, the gadget may fail to safeguard and shut down, or it may directly cause damage to the device. This work focuses on the control challenges of cascaded H-bridge STATCOM running under unbalanced grid voltage. The sequence components of the STATCOM output voltages and the grid voltages can be separated using the open-loop phase synchronization approach presented in [7,8] to deal with the phase disturbance of the grid voltage. This work obtains the quantitative relationship between the phase shift angles of positive and negative voltages from the standpoint of power balancing [9]. It also obtains the quantitative relationship between the modulation ratios of positive and negative voltages, and thus the effective coordination strategy of positive and negative voltages of STATCOM operating under imbalanced grid conditions [10].

EXISTING SYSTEM

Micro grid has an AC machine and DC- machine, connected with a tie line DC – AC motor. AC- machine of the micro grid can operate in coincidence with the mileage grid. In islanded mode of operation, i.e., in the absence of the mileage grid, voltage on AC machine is observed to show drastic oscillations with changing reactive power cargo on the Micro grid [11,12]. This provokes the need of a dynamic reactive power supplying and consuming element on AC machine. likewise, compensation of reactive power maximizes application of capacity of power transformers and creators. The proposed result for compensation of reactive power and minimize voltage oscillations is a static synchronous compensator on AC machine of the micro grid. It includes voltage source inverter (VSI) with a DC source bank in DC link. It is bedded with grid coinciding control system and DC link capacitor voltage regulating control system [13,14]. The STATCOM is dissembled with the being armature of COEP- micro grid and results of the same are modified.

PROPOSED SYSTEM

A Static synchronous Compensator (STATCOM) based on a hybrid cascaded H-bridge and full-bridge neutral point clamped (HC-FNPC) inverter is presented in this work. In terms of power components and voltage balancing capabilities, the benefits of HC-FNPC over symmetric and asymmetric cascaded H-bridge (HB) in STATCOM applications are demonstrated. Fulfil control goals, such as reactive current compensation and capacitor voltage balancing, a control approach is given. The STATCOM connected to the HC-FNPC consists of two types of cells: fully grounded cells (FNPC) and HB cells with one or two capacitors on the DC side. A hierarchical balancing scheme is proposed for voltage regulation of capacitors in mixed cells. In the first control sub cast, the voltage vectors of the cells are conditioned in such a way that a little active power is distributed between the cells [15,16]. In the alternative control subset, FNPC switching redundancy is used for voltage equalization. The introduced balancing scheme not only ensures voltage balance between capacitors, but also reversely distributes reactive power between cells and increases reliability. The performance of the proposed control is verified by MATLAB/SIMULINK field simulations and experimental results based on a nine-position STATCOM single-phase laboratory prototype connected to the HC-FNPC [17,18].

BLOCK DIAGRAM

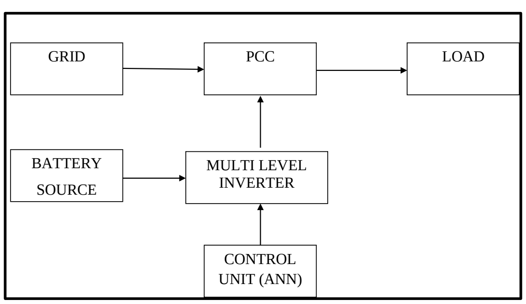

FIGURE 1: BLOCK DIAGRAM OF PROPOSED SYSTEM

A. GRID

A grid is a network of synchronised electricity sources and consumers linked by transmission and distribution lines and managed by one or more control centres. When most people talk about the power "grid," they are referring to the electrical transmission infrastructure [19].

B. CASCADED MULTILEVEL INVERTER.

Cascaded H-bridge multilevel inverters are more popular than diode clamped and flying capacitors. The H-bridge's output terminals are linked in series with the output terminals of another H-bridge to generate an alternating current voltage by summing of the output H-bridges [20,21].

C. ARTIFICIAL NEURAL NETWORK

The construction of artificial neural networks provides answers to issues that linear systems cannot. An artificial neural network is a model of our human brain. The sixth sense of the human brain involves comprehension, recognition, classification, grouping, error detection, and correction, and this skill is included with the assistance of an artificial neural network. This is a simulation of the biological nervous system.

D. BATTERY SOURCE

Electrical energy that is needed for the performance of multilevel inverter for voltage balancing is provided by battery source which is shown in figure 1.

DESCRIPTION OF COMPONENTS

A. STATCOM

STATCOM is a three-phase connection that connects electricity to ground. It is closely related to the products in the distribution system. The data currently used to determine the STATCOM key consists of two methods. One corresponds to the starting frequency of the load current removed using Adaline and the other corresponds to the loss in STATCOM, the DC voltage of STATCOM is estimated using a PI regulator. When STATCOM operates, it changes the relationship between DC side voltage and AC side voltage and mains frequency., the loss can be thought of as a function of the reactor coupling. The mains and AC voltage of STATCOM is VS and VSTA, voltage reactance is VL, reactor primary impedance is R, inductive reactance is X, and current is I [22,23].

B. MULTI-LEVEL INVERTER

Static inverters have no moving parts and are used in a wide variety of applications, from small power supplies in computers to large HVDC power plants that supply enormous amounts of electricity. Inverters are often used to supply AC power from a DC source such as a solar panel or battery [24]. The Electronic Converter is a powerful electronic oscillator. It got its name because the first AC-DC converters worked in reverse, thus "inverting" and converting DC to AC. The inverter converts DC power from sources such as batteries, solar panels, or fuel cells into AC power. Electricity can meet the need for electricity; In particular, it can drive AC equipment designed for critical operation or tune DC to produce the desired output. Grid Tie Inverters can feed back power to the distribution grid because they generate AC power at the same waveform and frequency as the distribution grid. They can also be turned off in the event of a power outage [25]. Electronic circuits that process encoded information as a voltage or current level limit. Logic circuits are household devices used in consumer and commercial products, including digital electronics. These products include digital computers, video games, speech synthesizers, pocket calculators and robot controllers. logic circuit, a circuit whose output is connected to the input, which can be represented as a function by logic symbols; It has one or more Binary inputs (which can be thought of as two states such as "on" or "off") and Binary output. Logic circuits that perform special functions are called gates. Basic logic circuits include AND gates, OR gates, and NOT gates that perform AND, OR, and NOT operations. Modern technology has created integrated logic circuits, complex functional models. The main use of logic circuits is electronic digital computers. Fluid logic circuits have improved their operation depending on the flow of liquid or gas rather than electronic devices.

MODELLING AND SIMULATION

The MATLAB has several helper toolkits provided by Math Works, Inc. are distributed to help you build models and simulate dynamic systems. It is optimization toolbox and control system toolbox. These toolkits are a collection of m-files developed for specialized applications. There is also a specialized program called Simulink, which is useful for modular construction and real-time simulation of dynamic systems. In MATLAB programming, functions are used to encapsulate calculations so that they can be used repeatedly, when necessary, without repeating the code. Additionally, functions can hide implementation details from the calling script. Subsystems play a similar role in Simulink [26].

RESULT AND DISCUSSION

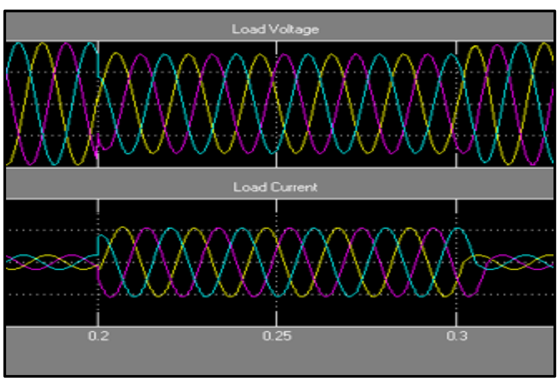

FIGURE 2: LOAD VOLTAGE AND LOAD CURRENT WITHOUT STATCOM

Figure 2 shows that without STATCOM the load voltage decreases and load current increases due to harmonic distortions.

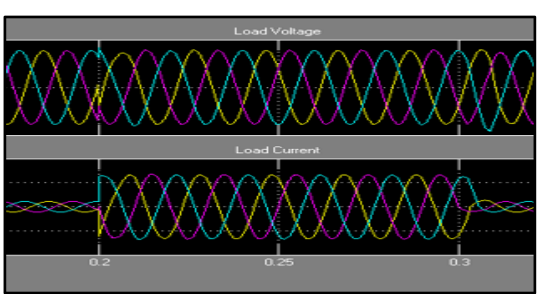

FIGURE 3: LOAD VOLTAGE AND LOAD CURRENT WITH STATCOM

Figure 3 shows that with STATCOM the load current decreases and load voltage increases without any harmonic distortions.

By comparing figure 2 and 3 without STATCOM the load voltage decreases due to some harmonic distortions but with STATCOM the harmonic distortions are reduced, and load voltage is balanced where voltage stability is achieved.

CONCLUSION

This project offers an integrated control method for the positive and negative transitions of the staggered H-bridge STATCOM that segregates used goods in good and tough times in case of an unstable power grid. From the analysis, we found that there is a relationship between the phase change angle and the positive and negative change of the system. The simulation results show that the method proposed in this paper can effectively solve the problem. In the case of system voltage asymmetry and phase interference, the device can work stably and realize electricity recovery at the same time.

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