Review Paper on RSC-MLC BASE SMART PV-DSTATCOM FOR MULTI OBJECTIVE PURPOSE

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Abstract- In this paper, the operation of D-STATCOM is presented and. The propose method optimized DC link Voltage, Improved power factor, compensate reactive power, reduce switching losses and harmonic distortion. The DC link voltage variation is controlled by real switch count multilevel convertor. It is also capable of supplying solar power to load. D-STATCOM modeled and simulated using MATLAB/SIMULINK software.

Keywords- D-STATCOM, Power quality PV system, Harmonics, MATLAB/ SIMULINK, RSC-MLC

1. INTRODUCTION

D-STATCOM is a custom power device which capable to inject a current into the system to correct the power factor and reactive power compensation and harmonics reduction's-MLC based smart D-STATCOM improves quality of power as well as compensates the flow of reactive power by using PV Source. During off-peak loads, the dc-link voltage can be brought down to a lower value, which will reduce the voltage-stress across switches of inverter and minimizes the switching losses. The variation of dc-link voltage is provided using RSC-MLC which requires dc voltage supply. This method utilizes renewable resources of energy such as solar cells as the dc voltage source.
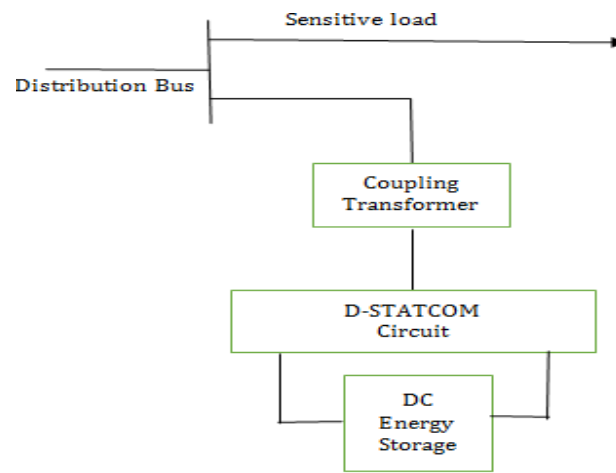
1.1 D-STATCOM

It is a compensating device which is used to control the flow of reactive power in distribution system. It is based on voltage source converter (VSC). It absorbs or generates controllable active and reactive power. It consists of a two-level Voltage Source Converter (VSC), a dc energy storage device, a coupling transformer connected in shunt to the distribution network through a coupling transformer. Proper adjustment of magnitude and phase of the DSTATCOM output voltages allows effective control of active and reactive power exchanges between the D-STATCOM and the ac system. In this paper, the D-STATCOM will be used to regulate the voltage at the point of connection. The control will based on space vector PWM and only requires the measurement of the RMS voltage at the load point. The DC side of the converter is connected to a DC capacitor, which carries the input ripple current of the converter and is the main reactive energy storage element. This capacitor could be charged by a battery source, or could be recharged by the converter itself. If the output voltage of the VSC is equal to the AC terminal voltage, no reactive power is delivered to the system. If the output voltage is greater than the AC terminal voltage, the D-STATCOM is in the capacitive mode of operation and vice versa as shown in fig-1

1.2 RSC-MLC based PV DSTATCOM

In the proposed method, the dc-link voltage regulation is achieved using Reduced Switch Count Multi Level Converter (RSC-MLC). The gate pulses of inverter switches are controlled using Hysteresis Controller which is faster and simpler. The gate pulses are derived using Instantaneous Symmetrical Component Theory (ISCT) to get the reference harmonic currents based on load demand. These harmonic currents are used to find the required reference dc-link voltage. The RSC-MLC is operated using Pulse Width Modulation (PWM) technique to obtain the desired level of dc-link voltage. The specialty of this RSC-MLC topology is reduced voltage stress at any operating condition across switches, which leads to reduction in switching losses.

Due to growing consumption of conventional sources of energy, there is a huge need to employ non-conventional resources in as many applications possible because they are freely available as well as non-polluting. During day time, PV panels produce maximum real power. Therefore, the batteries can be charged and real power support can also be provided.

Fig-1: Block diagram of D-STATCOM

At night, PV panels cannot deliver real power due to insufficient irradiation. In this case, the batteries will support the dc-link voltage for reactive power and harmonic compensation. The real power can be shared intelligently based upon the availability of irradiation and demand. The complete details of dc-link voltage variation using proposed RSC-MLC for achieving power quality improvement and injection of real power is discussed below extensively.

The proliferation of non-linear, inductive and unbalanced loads in the distribution system has led to several power quality issues. It is due to rapid rise in the use of sensitive equipment in industrial, commercial, domestic and traction applications such as switched mode power supplies, computers, refrigerators, televisions etc. The utilization side demands controlled supply of power which involves the use of power electronic converters. The generators produce a sinusoidal voltage but the currents drawn by such loads are distorted and unbalanced. This affects the feeder voltage and leads to malfunctioning of other loads connected to the same feeder. Several custom power devices (CPDs) have been used to overcome these issues. Out of these CPDs, Distribution Static Compensators (DSTATCOMs) are extensively used for mitigating the current-based power quality problems which include poor power factor, unbalanced currents and increased neutral current. Several DSTATCOM topologies and their design have been covered in existing literature based　　on the requirement. Some conventional methods are 4-leg.

2. LITERATURE REVIEW

[1] Sandeep Prajapati suggested the simulation and analysis of DSTATCOM for voltage sag mitigation and then harmonics distortion and power factor improvement using LCL passive filter with DSTATCOM in distribution system. The model, based on 2-level voltage source converter which requires only voltage measurements and reactive power measurements are not required. The operation of simulated control method for DSTATCOM (Distribution Static Synchronous Compensator) in MATLAB SIMULINK R2009b.

The simulation results give that voltage sags can be reduced by inserting DSTATCOM in the distribution system. After adding the LCL passive filter to system, the THD is reduced to IEEE STD 519-1992 and power factor increased. Thus it can help to improve power quality in distribution system by inserting DSTATCOM with LCL passive filter.

[2] Raj Arya suggested that distribution static compensator (DSTATCOM) is implemented for controlling a distributed power generating system using a proposed composite observer based control technique. The proposed control technique is employed for the fundamental components extraction of distorted load currents. These extracted components are used in the estimation of reference source currents to generate gating signals of DSTATCOM. The proposed control technique is implemented for the mitigation of reactive power, distortion in term of harmonics, and load balancing under linear/nonlinear loads. The performance of DSTATCOM is observed satisfactory for these consumer loads with regulated generator voltage at point of common coupling and self-supported dc link of voltage-source converter of DSTATCOM.

[3] Bhim Singh suggested that suggested that different Distribution Static Compensators (DSTATCOMs) topologies, state of the art, their performance, design considerations, future developments, and potential applications are investigated for power quality improvement. These DSTATCOMs for three-phase three-wire systems and three-phase four-wire systems are developed and installed in the distribution system for many functions, such as reactive power compensation, harmonics elimination, load balancing, and neutral current compensation. This paper is aimed to explore a broad perspective on DSTATCOMs to researchers, engineers, and the community dealing with the power quality improvement

[4] Divya Nair suggested that he role of FACTS (Flexible AC Transmission System) devices in addressing various power quality issues has been studied. In FACTS, power electronic devices and their switching control schemes are used for improving the power flow in the transmission network and hence improve the power quality and reliability of the low-voltage distribution network. These devices can play a significant role in maximizing the power transmission capability of the transmission network and providing high power quality at the point of common coupling (PCC) of the distribution system. The Distributed Static Compensator or DSTATCOM is a type of FACTS controller and has the function of reactive power compensation and harmonic mitigation. This paper discusses the use of synchronous detection algorithm for implementation of DSTATCOM for mitigation of harmonics. The dynamic performance is analyzed and verified through simulation.

[5] Prabhir Ranjan Kasari illustrates the power quality improvement aspects in distribution system by DSTATCOM based on d-q-0 reference frame. The utilities like domestic, commercial and industrial are facing numerous PQ problems in the form of voltage dip, swell and voltage variations or fluctuations. The contributions of these power quality issues are severe in our existing electrical systems nowadays. In this work the estimation and mitigation of voltage sag, voltage swell, voltage fluctuation and reactive power limiting for different loading condition in utility by using Custom Power Devices. The D-STATCOM has taken as a compensating device, since it known for its flexibleness, easy implementation, dynamic load compensation & multifunctional operation. The model of D-STATCOM connected in shunt with a three-phase source feeding a constant and a variable load, which is develop using Simulink. The Simulated result demonstrates that D-STATCOM can consider as a feasible solution for solving voltage dip, swell and fluctuation problems.

3. PROPOSED WORK

Power Quality problems will be improved by modeling and simulation of RSC-MLC based D-STATCOM using PV power. The Advantages of this work will be Reactive power will be compensated, switching losses of convertor will be reduce, Total harmonic distortion will be reduces. The proposed method also provides real power to load in peak demand. The Propose model as shown in fig-2.
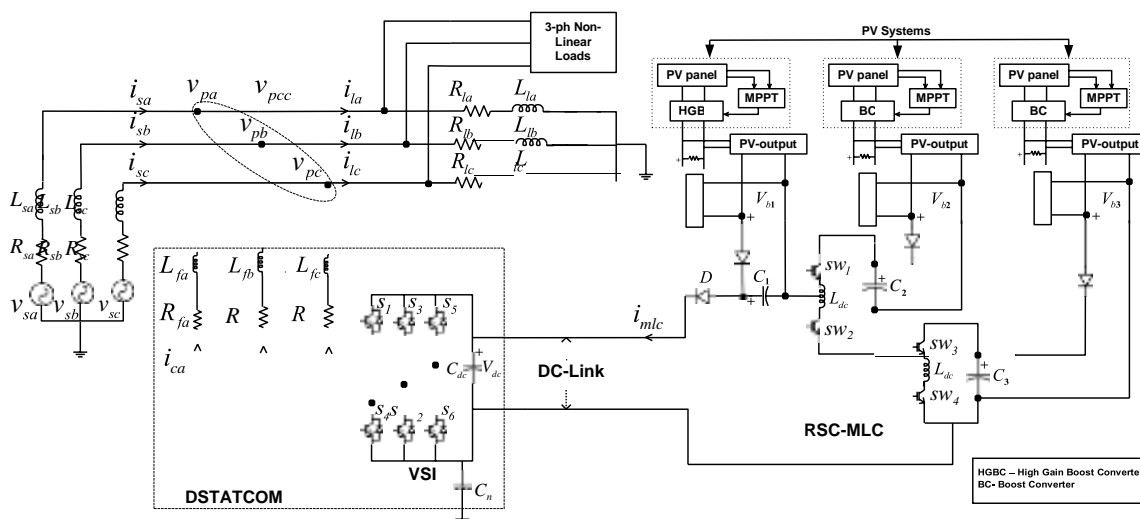

Fig-2: Proposed model RSC-MLC BASE SMART PV-DSTATCOM

CONCLUSION

D-STATCOM is a best device to improve power quality problem in distribution system among all power devices. D-STATCOM using real switch count multi level convertor to which solar power is given as input. Due to this technique switching losses will be reduce as well as reactive power is compensated and total harmonic distortion will be reduces. Also real power is provided in case of emergency by using solar power during peak demand.

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