D-STATCOM based on GTO Converter in the Application of Eleven Level Multilevel Inverter

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Abstract--- In Distribution system,on the load side the power quality is majorly maintained by the Distributed Static Synchronous Compensator (D-STATCOM). This paper deals with the major function of the D-STATCOM with-11 level inverter.Instead of 54-pulse converter we are using 11-level inverter for D-STATCOM in distributed system. Normallyfifty four pulse converter is expensive and complicated operatingsince it has nine transformers and nine-six pulse converterin order to overcome this issue here we use a 11-level multilevel inverter. The proposed structure consists of only one transformers and 11-level inverter therefore operation is simple and easy and also it is cost efficient. The simulation works are done in MATLAB\Simulink software.

Index Terms--- DSTATCOM, 54 Pulse Converter, 11-level multilevel inverter.

I. INTRODUCTION

Now a days we face a lot of issues in the field of power quality. Various issues are solved by power electronic devices. Advancement in IGBT's has led to the improvement in fast control of phantom power in the utilizationof distributionsystem. These advancements are cost efficient, highly efficient and fast in control. Therefore improving the quality and maintaining itbecomes unavoidable. In distribution systems the maintaining of power quality is more important and we use FACTS devices for this use.

Power quality is nothing but the compatibility between the outcome of an electric output and the load that is inserted into it.Flexible AC Transmission Systems(FACTS) gadgets are devices which are alsomainly used for efficient control of voltages.

D-SATCOM which is a FACTS device is put to use here to maintain the power quality.D-STATCOM is a compensating device which is used for the control of the flow of reactive power in the distribution systems.

VSI is used to replace Thyristor-Switched Capacitor (TSC) and Thyristor Controlled Reactor (TCR) for flexible reactive power compensation. In this extract, a multilevel converter of eleven levels model is cascaded for the operation of D-STATCOM in distribution system. Fig 1 shows the general fifty four pulseD-STATCOM with nine transformers and nine six pulse converters.

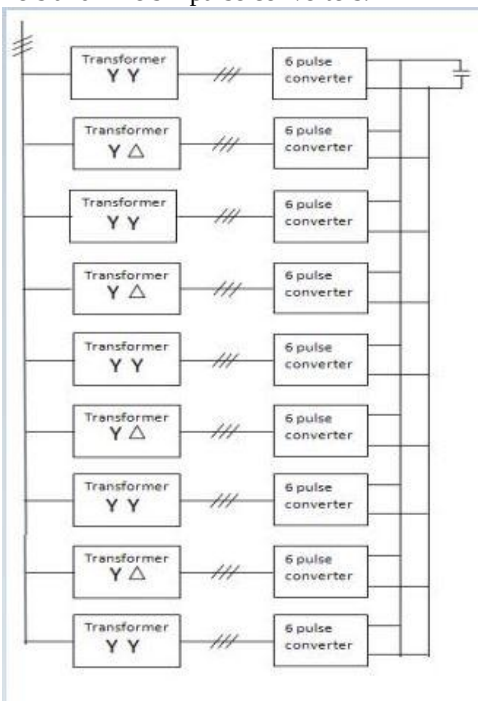

Fig. 1: Fifty four pulse D-STATCOM (Nine transformers and Nine-six pulse converters)

II. PROPOSED CONTROLLER

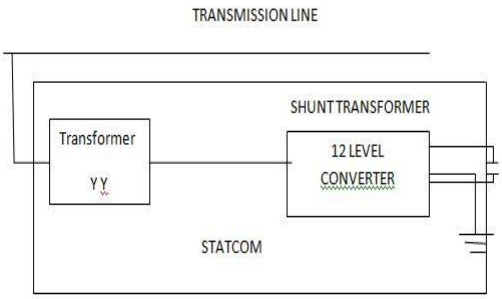

Fig. 2: Structure Proposed

Fig 2 shows the proposed structure of the eleven level converter connected to a single transformer.A d-q decoupled current controlled system is monitored by D-STATCOM. Here PI controller is used to derive the value of quadrature axis current, making use of

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the bus and RMS voltages as reference.
Similar to this, a dc link voltage controller gives out the direct axis current. Hence the desired values are extracted from the current controller.This signal is generated with the help of PLL. The compensation behaviour of D-STATCOM device is determined by the regulation slope.It helps in improving the fast controllability of D-STATCOM.

III. D-STATCOM

By varying the amplitufe and phase angle of the inverters voltage wrt line terminal voltage, D-STATCOM helps in exchanging the active part and reactive part in the distribution system..D-STATCOM stands for Distribution static synchronous compensator which is a compensating device.It consist of two feeders and transmit power to loads.The shunt capacitor found in D-STATCOM is used for power factor correction. D-STATCOM has the ability to mitigate the voltage flicker that occurs mostly in a plant absorbing continuously changing current which is similar to an arc furnace.

Distribution static synchronous compensator is used to regulate voltage on a distribution network. A shunt capacitor is used for power factor correction.It consist of transformer with leakage reactance and is stepped down. The DSTACOM regulates the voltage in order to improve the voltage profile this is done by dc side capacitor.

A square waveform is produced by the inverter, thus allowing the dc voltage source switches to vacillate between ON and OFF.

The effects of harmonics can be dimmed with usage of a multilevel inverter. Magnetic coupling can be implemented to dampen harmonic neutralization. A fifty four pulse GTO can be obtained on combining two or four VSI's. These fifty four pulses are used in high power applications, where low distortions are a necessity, using parallel filters. These fifty four pulses ensure minimal harmonic resonance in the grid, and also give minimal problems with respect to power quality.

A complete eleven level converter using D-STATCOM is proposed in this paper. TheSimulation for 11- level multilevel inverter is performed using MATLAB/SIMULINK software. D-STATCOM is called Distribution Static Synchronous Shunt Compensator, used for real and reactive power compensations at distribution level, ESTATCOM is Energy Storage Equipped Static Synchronous Compensator which is used for storage of energy. A multilevel inverter dampens harmonics and voltage by summing up the different levels of output voltage.

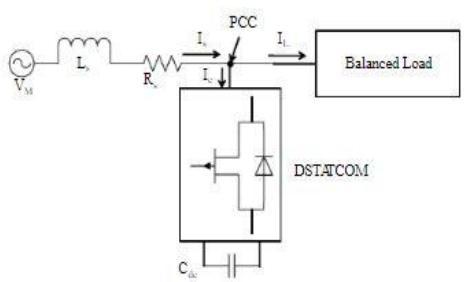

Fig. 3: One line diagram of D-STATCOM

IV. CONTROL MODEL OF D-STATCOM

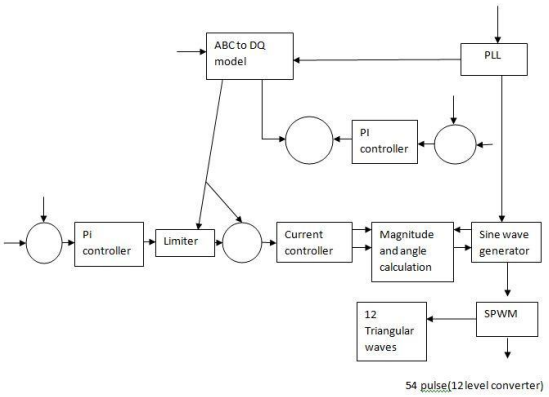

Fig. 4: Model of D-STATCOM for eleven levelconverters.

V. ELEVEN LEVEL H- BRIDGE INVERTER

A multilevel is a device that reduces the voltage and the harmonics by adding the levels of output voltage. There are various types of inverters.They are:

1. Dioide clamped
2. Cascaded H bridge
3. Flying capacitor

Among the above mentioned inverters Cascaded H bridge is popularly suitable for D-STATCOM because of its modularity and simple in function. It is economical and decreases the effects of harmonics . It is widely used ihigh voltage conditions. Each unit of H bridge is connected in cascade in order to generate fair voltage and the harmonic distortion level is deminished.

The cascaded H bridge multi level inverter which is connected in series with a multiple sets of H bridge cells in order to generate High AC voltages.Here in each phase two bridge cells gets powered with the help of two isolated dc supplies of same voltage. The multi pulse diode rectifier acts as a dc suppliers. The phase voltages on different levels can be gained by changing the switches at nominal conduction. Sometimes the phase voltage at some levels is obtained only by giving more switching states.The switching state reduntancy provides a greqtflexiblity for the design of switching.

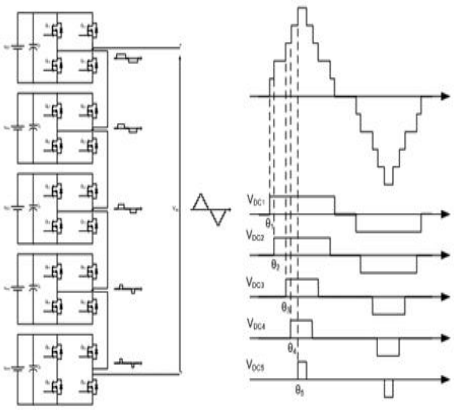

Fig. 5: 11 level Multilevelinverter and pulsating schemes

VI. RESULT

In this paper the simulation of multilevel inverter is performed and the output simulation is provided for each input given.

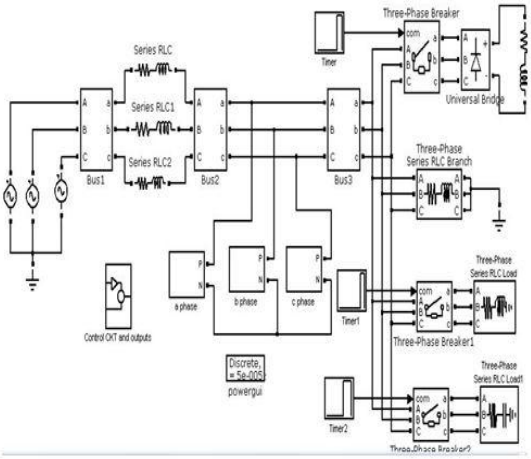

Fig.6: MATLAB simulation of 54 pulse D-STATCOM

Fig.7 shows the outcome of above proposed structure.

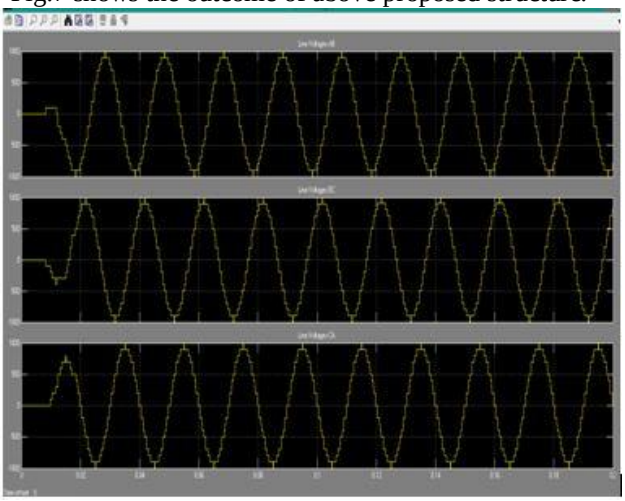

Fig. 7: Output of MATLAB/Simulink

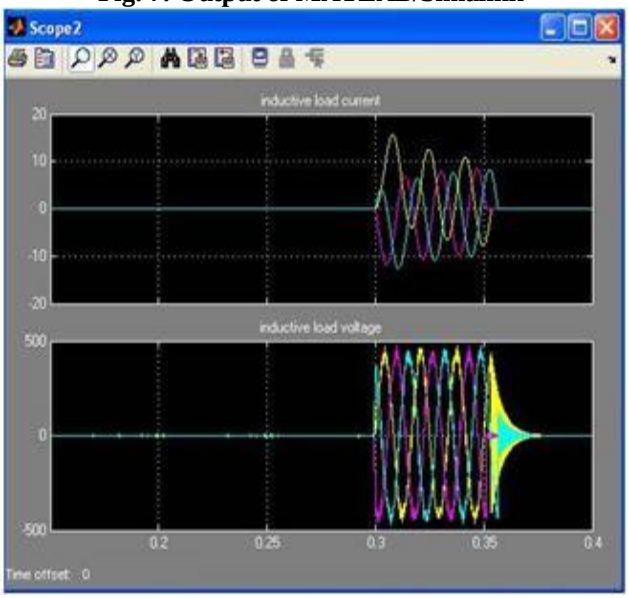

Fig. 8: Operation under various conditions.

VII. CONCLUSION

This paper presents eleven level multilevel converter which is H bridge cascaded. It acts as a D-STATCOM.The above proposed journel will be able to produce the required pulses for the multi level inverter which will deliver the outcome from eleven level voltage. With the help of these techniques the harmonic distortion can be compensated for the non linear load system.The Simulink model for a eleven level multi level inverter based D-STATCOM is simulated in MATLAB.

The voltage source inverter which is connected to the AC system parallely is used for distinct purposes.They are the following:

1. Regulation of voltage
2. Reactive power compensation
3. Avoiding Harmonic Distortion
4. Power factor correction

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