ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 2, February 2017

Enhancement of Power Quality by Using D-Statcom

[1] Mr. S.S.Godhade [2] Miss.Archana Chavan [3] Miss.Supriya Patsupe, [4] Mr.Swapnil Gaikwad
[5]Mr.Shivpratap Patil [6]Mr.Amanulla Naikwade
[1]-[6] Electrical Engg.Department, SGI,Atigre,Kolhapur,Maharashtra,India

***Abstract*— There are different ways to improve power quality problems in electrical power system. Among these the D-STATCOM is one of the most effective devices. A pulse width modulation scheme has been implemented to control the gates circuit of the D-STATCOM Controller. To improve the quality of power, active power filters have been proposed. The distribution static compensator (DSTATCOM) is a shunt active filter, which injects currents into the point of common coupling (PCC) (the common point where load, source, and DSTATCOM are connected) such that the harmonic filtering, power factor correction, and load balancing can be achieved. The DSTATCOM filters load current such that it meets the specifications for utility connection.**

***Keywords:--* Power quality, PCC, PWM, D-STATCOM components.**

I. INTRODUCTION

The majority of power consumption has been drawn in reactive loads such as pumps, electric motors, electric welding etc. These loads draw lagging power-factor currents and therefore give rise to reactive power burden in the distribution system. The excessive reactive power demand increases feeder losses and reduces the active power flow capability of system where as unbalancing affects the operation of transformers and generators. Reactive power plays a vital role on the stability of power system. Therefore, the reactive power compensation is necessary in the power systems. The Harmonic currents in distribution system can causes harmonic distortion, Low power factor and also causes heating in electrical equipment. It also can causes vibration and noise in machines and so the damaging of sensitive machine parts.

There are different ways to improve power quality problems in electrical power system. Among these the D-STATCOM is one of the most effective devices. A pulse width modulation scheme has been implemented to control the gates circuit of the D-STATCOM Controller.
To improve the quality of power, active power filters have been proposed. The distribution static compensator (D-STATCOM) is a shunt active filter, which injects currents into the point of common coupling (PCC) (the common point where load, source, and D-STATCOM are connected) such that the harmonic filtering, power factor correction, and load balancing can be achieved. In practice, the load is remote from the distribution substation and is associated with feeder impedance. In the presence of feeder impedance, the inverter switching distorts both the PCC voltage and the source currents. In this situation, the source is termed as non stiff.

The D-STATCOM filters load current such that it meets the specifications for utility connection. If properly utilized, this device can cancel

- The effect of poor load power factor such that the current drawn from the source has a near unity power factor;
- The effect of harmonic contents in loads such that current drawn from the source is sinusoidal.

II. LITERATURE REVIEW

Static Synchronous Compensator (STATCOM)

STATCOM is one of the key FACTS Controllers. It can be based on a voltage sourced or current-sourced converter. As mentioned before, from an overall cost point of view, the voltage-sourced converters seem to be preferred, and will be the basis for presentations of most converter-based FACTS Controllers. For the voltage-sourced converter, its ac output voltage is controlled such that it is just right for the required reactive current flow for any ac bus voltage dc capacity or voltage is automatically adjusted as required to serve as a voltage source for the converter. STATCOM can be designed to also act as an active filter to absorb system harmonics.

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 2, February 2017

DISTRIBUTED STATIC COMPENSATOR (DSTATCOM)

The Distribution Static Compensator (DSTATCOM) is a voltage source inverter based static compensator (similar in many respects to the DVR) that is used for the correction of bus voltage sags. Connection (shunt) to the distribution network is via a standard power distribution transformer. The DSTATCOM is capable of generating continuously variable inductive or capacitive shunt compensation at a level up its maximum MVA rating. The DSTATCOM continuously checks the line waveform with respect to a reference ac signal, and therefore, it can provide the correct amount of leading or lagging reactive current compensation to reduce the amount of voltage fluctuations. The major components of a DSTATCOM are shown in Fig. 2. It consists of a dc capacitor, one or more inverter modules, an ac filter, a transformer to match the inverter output to the line voltage, and a PWM control strategy. In this DSTATCOM implementation, a voltage-source inverter converts a dc voltage into a three-phase ac voltage that is synchronized with, and connected to, the ac line through a small tie reactor and capacitor (ac filter).

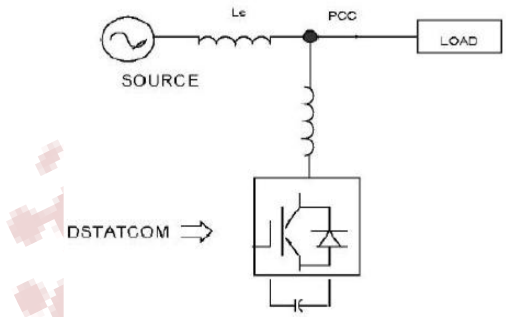

Fig.1.Block diagram DSTATCOM circuit.

DSTATCOM components:
DSTATCOM mainly involves three parts

IGBT or MOSFET based dc-to-ac inverters:
These inverters are used which create an output voltage wave that's controlled in magnitude and phase angle to produce either leading or lagging reactive current, depending on the compensation required.

L-C filter:
The LC filter is used which reduces harmonics and matches inverter output impedance to enable multiple parallel inverters to share current. The LC filter is chosen in accordance with the type of the system and the harmonics present at the output of the inverter.

Control block:
Control block is used which switch Pure Wave DSTATCOM modules as required. They can control external devices such as mechanically switched capacitor banks too. These control blocks are designed based on the various control theories and algorithms like instantaneous PQ theory, synchronous frame theory etc.

III. BASIC OPERATING PRINCIPLE

Basic operating principle of a DSATCOM is similar to that of synchronous machine. The synchronous machine will provide lagging current when under excited and leading current when over excited. DSTATCOM can generate and absorb reactive power similar to that of synchronous machine and it can also exchange real power if provided with an external device DC source.

1) Exchange of reactive power:- if the output voltage of the voltage source converter is greater than the system voltage then the DSATCOM will act as capacitor and generate reactive power(i.e.. provide lagging current to the system)

2) Exchange of real power: as the switching devices are not loss less there is a need for the DC capacitor to provide the required real power to the switches. Hence there is a need for real power exchange with an AC system to make the capacitor voltage constant in case of direct voltage control. There is also a real power exchange with the AC system if DSTATCOM id provided with an external DC source to regulate the voltage incase of very low voltage in the distribution system or in case of faults. And if the VSC output voltage leads the system voltage then the real power from the capacitor or the DC source will be supplied to the AC system to regulate the system voltage to the =1p.u or to make the capacitor voltage constant.

Hence the exchange of real power and reactive power of the voltage source converter with AC system is the major required phenomenon for the regulation in the transmission as well as in the distribution system. For reactive power compensation, DSTATCOM provides reactive power as needed by the load and therefore the source current remains at unity power factor (UPF). Since only real power is being supplied by the source, load balancing is achieved by making the source reference current balanced. The reference source current used to decide the switching of the DSTATCOM has real fundamental frequency component of the load current which is being extracted by these techniques.

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 2, February 2017

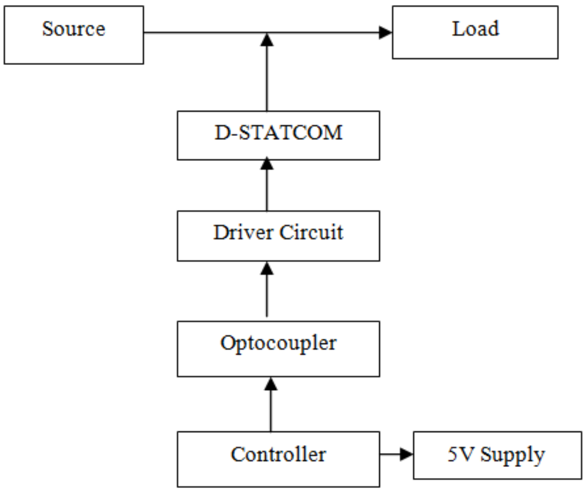

Fig.2.Block Diagram of Proposed System

IV. CONTROL STRATEGY
SINUSODAL PWM:

Sinusoidal PWM technique is used which is simple and gives a good response. The error signal obtained by comparing the measured system RMS voltage and there reference voltage, is fed to a PI controller which generates the angle which decides the necessary phase shift between the output voltage of the VSC and the AC terminal voltage. This angle is summed with the phase angle of the balanced supply voltages, assumed to be equally spaced at 120 degrees, to produce the desired synchronizing signal required to operate the PWM generator.