A NOVEL PWM BASED STATCOM CONTROLLER FOR POWER QUALITY ENHANCEMENT IN DISTRIBUTED SYSTEM

Yuvraj Jangid* Sunil Kumar Mahapatro Dr. Parmod Sharma****

*M.Tech Scholar, Department of Electrical Engineering, Regional College for Education Research & Technology , Jaipur , Rajasthan , India.
**Assistant Professor, Department of Electrical Engineering, Regional College for Education Research & Technology , Jaipur , Rajasthan , India.
***Associate Professor, Department of Electrical Engineering, Regional College for Education Research & Technology , Jaipur , Rajasthan , India.

***Abstract*: Static Synchronous Compensator has the capability for the improvement in damping factor and stability by managing the reactive power output. As the STATCOM will itself absorb the reactive power which comes from the distribution line when we apply the capacitive load. To get the higher performance of STATCOM we are mainly depend over control algorithms. As the real power factor has been absorb by the STATCOM at the time when the capacitor is charging and at the situation when the capacitor is completely charged there is no absorption of real power is occur. The following observation are concluded Minimum ripple in solar PV Micro Grid model DC current and Voltage Minimum Swell in Voltage and current when solar based DG is Integrated to Grid with using STATCOM Voltage source inverter is controlled by Space vector pulse width modulation converting solar DC to AC.**

I. Introduction

In early 19th century when the electricity, when the commercial use of electricity has been started there are various issues has been occurred while electricity transmission like voltage fluctuation due to change in load and there are several power transmission limitations are present due to unbalance in reactive power. As now days electricity is the most important part of daily life so all these factors have higher impact on power supply due to continuous industrialization which increase the power supply demands. Due to continuous development over the time there are several compact semiconductor devices has been developed which allow new power electronic configuration in power transmission and load flow control. Thus by these devices we can get reliable and efficient control over power transmission. Consequently the custom powers is for low voltage distribution and thus increase the quality and thus increase the reliability of supply which affect the sensitive load. There is very similarity between these devices and FACTS [1]. The commonly used power devices are DVR, STATCOM, UPQC. Among these the STATCOM is a custom power product, this is an power electronic devices which is connected with shunt and used to compensate the reactive power factor, which means it provides the protection for electrical equipment from this polluted load supply.[3]. the performance of D-STATCOM can be calculated by the controlling algorithm which is the extraction of current components. The performance of D-STATCOM can be calculated by using controlling methods. Thus for measuring the performance several algorithms have been developed on the basis of various theories and one of this is IRP theory [4- 11]. In this thesis our main focus is to compensate the voltage fluctuation and the voltage interruptions. Thus we can analyze the dynamic performance by the simulation.

The main cause of these voltage sags are problem in utility systems or the problems in customer facilities or increase in load current, this will result while starting the motor or transformer energizing. These are most common power quality problem which occur in power transmission. While in commercial and industrial use the voltage sag are the most common problems and they cause various problems to machinery and even in production thus may cause economical losses. Thus here our main focus is on the disturbances caused from end to end user devices as the major power quality issue [6]. This paper is organized as follows. Section I explains the basic introduction of D-STATCOM. On the other hand research methodology is define in Section II. Section III gives the overview of design configuration, section IV introduces D-STATCOM model, and result & discussion section V is a conclusion.

II. Research Methodology

Generally we categorize the control methods for the D-STATCOM in two categories they are: indirect control and the direct control. [8] , in the case on current indirect control we will assume the D-STATCOM as a voltage source by the control on the AC voltage wave phase and the amplitude which is generated by the inverter side for the indirect control over the AC side current. Thus by managing the phase δ for the output voltage and the system voltage or in integration with the control pulse width θ for the compensation system; the direct current control method will use the track PWM method on the current instantaneous value to feedback control. As the result which we obtain from the indirect control method are much simple and In such cases the control precision are not taken to be high and thus they are not have much faster response and in opposite to this the direct control method provide the much faster response and in this the control precision are also very high so the direct control can get the effect which will not be obtain by the indirect method, thus due to this reason in this article we adopt the direct control method instead of indirect control method due to its advantageous nature over the other one and by using this we can get the harmonic current and the reactive power signal and then we disconnect the reactive channel iq (and iq=0) [12].

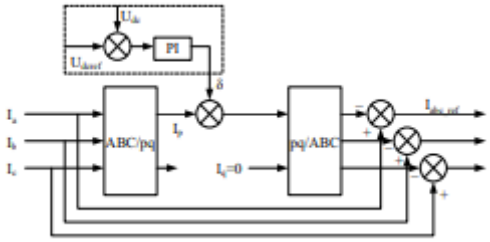

Fig 1 Instantaneous reactive and harmonic current detection

While tracking the PWM control technology we use the hysteresis comparison method, this method is also use for the triangle wave comparison [9,10], Thus the triangle wave comparison control will detect the variations among the current real value and the reference value with the high frequency triangular carrier phase pulse, thus the proposed control process is depicted in the figure 2 below:

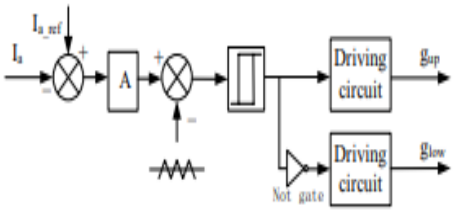

Fig 2 Triangle wave comparison

In Figure 2 shown above we show that the control mode is different in use for the other triangular wave as carrier wave of PWM control, as this will not order the signal comparison with the triangular wave, but by the variation in command current and the compensation current to the amplifier A and then we compare it with the triangular waveform. Thus here the triangular carrier will direct the current control method which will realize the simultaneous compensation for the reactive power and the harmonics, and here the DC side voltage control will make it stable thus by this we can get the stable, precise and accurate compensation effect [13].

III. Proposed Design

The advantage of the fuzzy inference system is that it can deal with linguistic expression. The idea behind neural network and fuzzy inference combination is to design a system that uses a fuzzy system to represent knowledge in an interpretable manner and has the learning ability derived. Simulink is a block diagram environment for multi domain simulation and Model-Based Design. It is integrated with MATLAB, enabling you to incorporate MATLAB algorithms into models and Export simulation results to MATLAB for further analysis. The goal of this module was to provide enough of an introduction to get you started on the development of open- and closed-loop simulations.

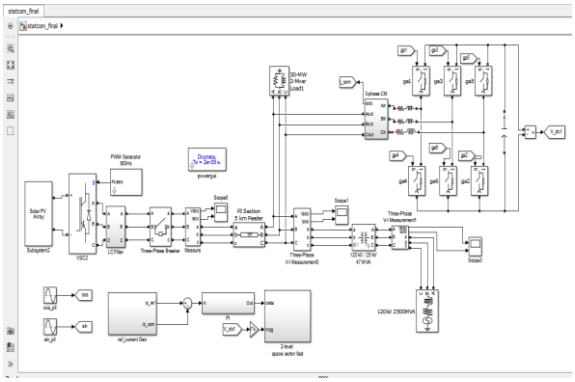

Fig 3 Simulink Model of Proposed D-STATCOM

Simulink model of proposed D-STATCOM is shown in fig 3 .The Simulink model contain Solar PV Array & Circuit barker & 30MW load on the model

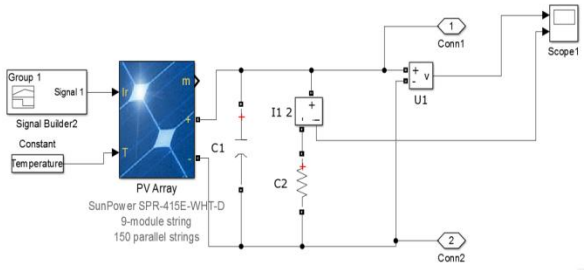

Fig 4 Solar Array

III. Results and Discussion

Three Phase Grid Voltage and Current using D-STATCOM is shown in fig 5. The grid current is varied from 15 ampere & grid voltage is varied from 15 mega volt.

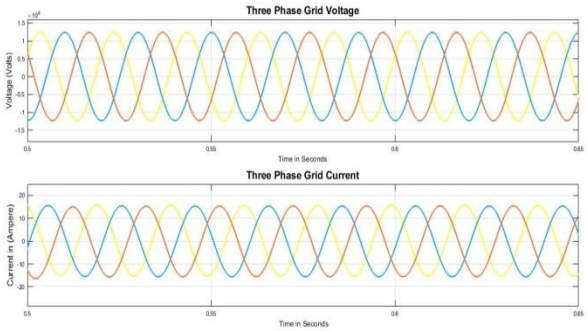

Figure 5 Three Phase Grid Voltage and Current using D-STATCOM

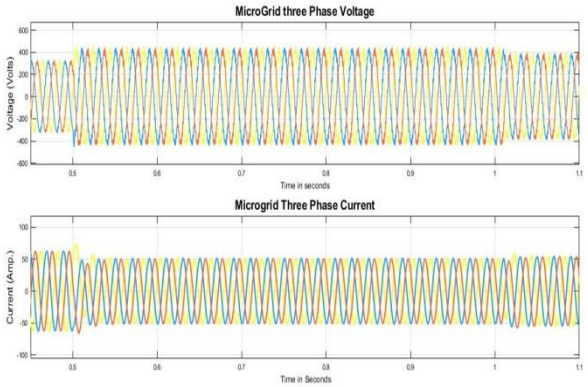

Figure 6 Three Phase Micro Grid Voltage and Current using D-STATCOM

Three Phase Micro Grid Voltage and Current using D-STATCOM is define in fig 6. The voltage is varied to -250 to 250 up to 0.5 sec. Then it is increase to 450 V up to 1.1 sec

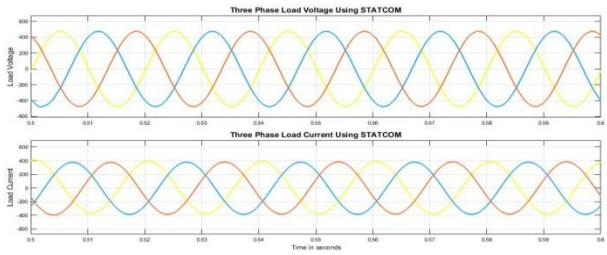

Figure 7 Three Phase Load Voltage and Current using D-STATCOM

Three Phase load Voltage and Current using D-STATCOM is define in fig 7. The voltage is varied to -400 to 400 upto 0.5 sec. Then it is increase to 450 V upto 1.1 sec.

IV Conclusion

From this present study we come to know about the importance of D-STATCOM in voltage regulation in a distribution system. As the D-STATCOM will itself absorb the reactive power which comes from the distribution line when we apply the capacitive load. By using a voltage source inverter the STATCOM will generator the reactive power by the means of capacitor. To get the higher performance of D-STATCOM we are mainly depend over control algorithms. As the real power factor has been absorb by the D-STATCOM at the time when the capacitor is charging and at the situation when the capacitor is completely charged there is no absorption of real power is occur. Total harmonics distribution is 0.95 % in 3 phase Load current with using D-STATCOM D-STATCOM help to reduce 0.95% (THD) total harmonics and also control Sag and Swell Problem which is generated by solar Based Distributed Generation or Micro grid .1 KHz switching frequency of SVPWM in Voltage source inverter very less power device loss

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