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REVIEW ON POWER QUALITY IMPROVEMENT USING DISTRIBUTION STATIC SYNCHRONOUS COMPENSATOR (D-STATCOM)

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Abstract *— Maximum ac load consumes reactive power,it causes poor power quality in power system.the d-statcom is compensating device which is used to control the flow of reactive power in the distribution systems.the complete background of the compensating devices and power electronics application in compensating devices is presented in this paper and also the compensation using the d-statcom modeling is also discussed.the different control strategies are presented.*

Keywords- *Reactive power compensation, d-statcom, power control and power quality*

I. INTRODUCTION

Load In the early days of power transmission in the late 19th century problems like voltage deviation during load changes and power transfer limitation were observed due to reactive power unbalances. Most of the AC loads are consuming reactive power due to presence of reactance. Heavy consumption of reactive power causes poor voltage quality. Today these Problems have even higher impact on reliable and secure power supply in the world of Globalization and Privatization of electrical systems and energy transfer. The development in fast and reliable semiconductors devices (GTO and IGBT) allowed new power electronic Configurations to be introduced to the tasks of power Transmission and load flow control. The FACTS devices offer a fast and reliable control over the transmission parameters, i.e. Voltage, line impedance, and phase angle between the sending end voltage and receiving end voltage. On the other hand the custom power is for low voltage distribution, and improving the poor quality and reliability of supply affecting sensitive loads. Custom power devices are very similar to the FACTS. Most widely known custom power devices are DSTATCOM, UPQC, DVR among them DSTATCOM is very well known and can provide cost effective solution for the compensation of reactive power and unbalance loading in distribution system.

II. DIFFERENT CONTROL STRATEGIES

The main function of control strategies is to generate the proper PWM triggering pulsaes.because of similar concepts to the statcom some controlling strategies are directly employed to a d-statcom.The main controlling stratagies for reactive power compensation are:

i. Phase Shift Control
ii. Decoupled Current Control (p-q theory)
iii. Regulation of ac bus and dc link voltage
iv. Synchronous Reference Frame (SRF) Method

i. Phase shift control

Fig.1 shows the block diagram of the implemented scheme.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 the 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. In this algorithm the D.C. voltage is maintained constant using a separate dc source.

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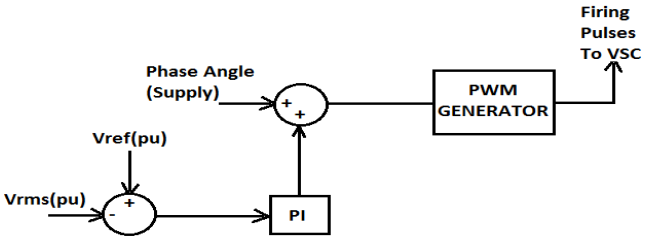

Fig.1.Phase shift control

ii.Decoupled current control(p-q theory)

This algorithm requires the measurement of instantaneous values of three phase voltage and current. Fig.2. shows the block diagram representation of the control scheme. The compensation is achieved by the control of id and iq. Using the definition of the instantaneous reactive power theory for a balanced three phase three wire system, the quadrature component of the voltage is always zero, the real (p) and the reactive power (q) injected into the system by the DSTATCOM can be expressed under the dq reference frame as:

p=vd id+vq iq

q=vq id-vd iq

Since vq=0, id and iq completely describe the instantaneous value of real and reactive powers produced by the DSTATCOM when the system voltage remains constant. Therefore the instantaneous three phase current measured is transformed by abc to dqo transformation. The decoupled d-axis component id and q axis component iq are regulated by two separate PI regulators.

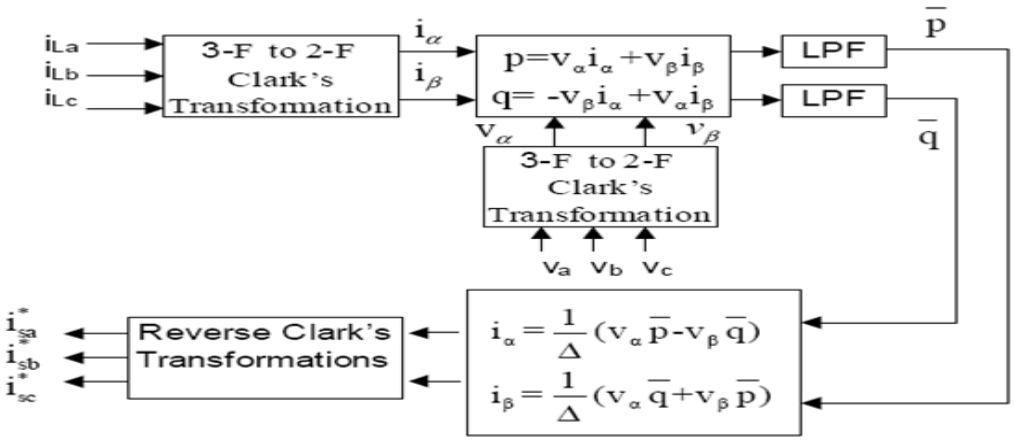

Fig.2.Decoupled current control(p-q theory)

iii.Regulation of ac bus and dc link voltage

This compensation scheme is multifunctional and can be effectively used for load balancing and harmonic suppression in addition to power factor correction and dynamic voltage regulation. Three phase ac supply voltages and DC link voltage is sensed and fed r two PI controller , the outputs of which decide the amplitude of the reference reactive and active current to be generated by the DSTATCOM. Fig.2. shows the block diagram of the implemented scheme. Multiplication of these amplitudes with the in phase and quadrature voltage unit vectors yields the respective component of reference currents. When applying the algorithm for power factor correction and harmonic elimination the quadrature component of the reference current is made zero. The summed direct and quadrature axis reference currents and the sensed line currents are fed to carrier less hysteresis controller which is used for tracking control. The converter switching actions are generated from a hysteresis controller which adds a hysteresis band +/-h around the calculated reference current.

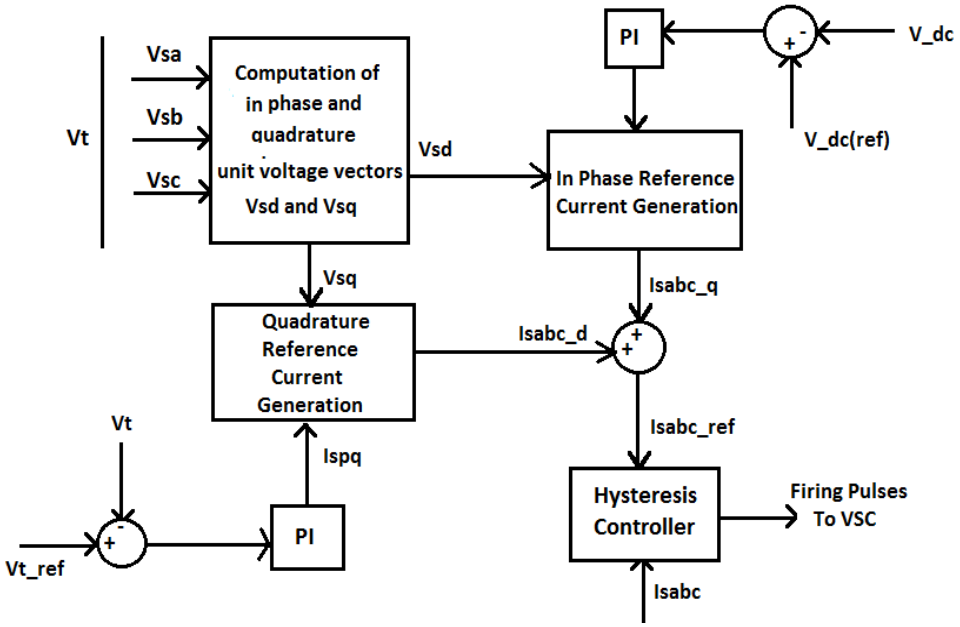

Fig.3.Regulation of ac bus and dc link voltage

iv.Synchronous reference frame theory(srft)

The synchronous reference frame theory is based on the transformation of the currents in synchronously rotating d-q frame. Fig.4explains the basic building blocks of the theory. If θ is the transformation angle, then the currents transformation formation α-β to d-q frame is definened as:

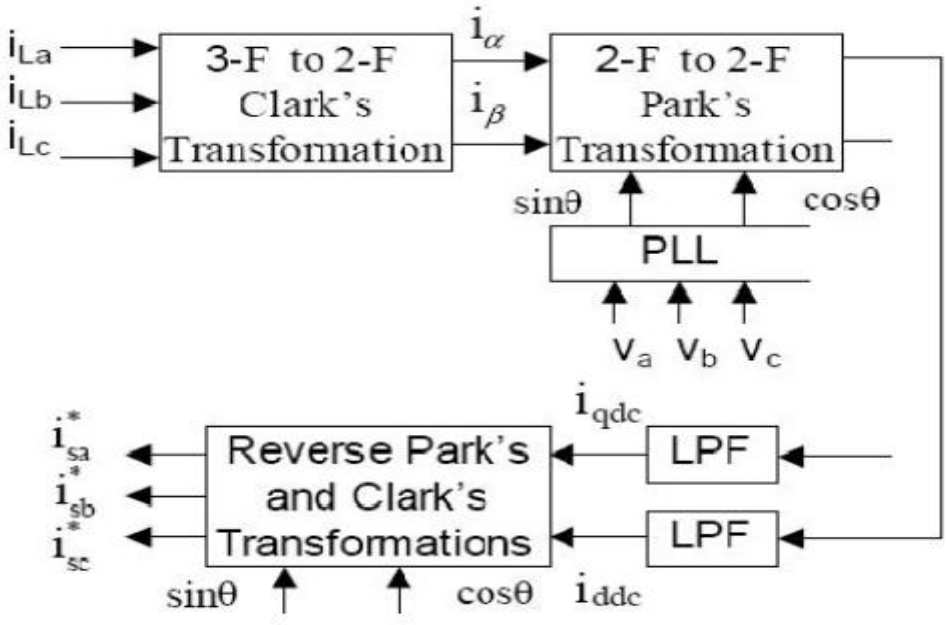

Fig.4.synchronous reference frame theory(srft)

III. CONCLUSION

In this paper,custome power device can used,at reasonable cost,to provide high power qualitiy and improved power service. I have present a review of different control strategy have are used for reactive power compensation to compensate the source current because of the unbalanced load and nonliear power electronic load.

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