Power Quality Improvement using DSTATCOM for Power System

Mohd. Abdul Kareem , Nomula Ganesh, Patlolla Rushikesh, Naveen Kumar D., N Bheemaiah

Abstract*: Reactive power is created once this undulation is out of point in time with the voltage undulation thanks to inductance or capacitance load. Amp lag volt with associate angle for inductive load, lead volt for capacitor. The KVAR of the system should be compensated in order to smooth running of power system. There are various types of loads i.e. transformers, furnaces, induction motors etc. These types of loads require reactive power to sustain flux because this type of appliance major depends on flux density. Based on reactive power efficiency is regulated and efficiency of the system is incurred. DSTATCOM is a device which manages reactive power in a system. This device had quick management. Distribution synchronous compensator performance is carried out using Algorithm rule. This paper explains learning of reference current generation technique from decoupled amp management i. e p-q theory is based on voltage compensation using converter is utilized in this paper. Reference current developed by management topology are traced by compensator during physical phenomenon band management scheme. STATCOM module with HCC(Hysteresis current control) square measured , generated and simulated in Matlab software using simulation . DSTATCOM is very efficient in controlling reactive power.

Index Terms: Voltage source converter , Compensation of Q power, Distribution System ,PQ Theory and HCC (Hysteresis current control).

Keywords: DSTATCOM; Voltage Source Converter; Distribution System; Decoupled Current Controller; Hysteresis Current Controller.

I. INTRODUCTION

In distribution system, the reactive power is absorb by fans, pumps etc. these gadgets draws reactive power issues and by making burden on generation of reactive power. Therefore there is demand for reactive power generation increase with decrease in active power where as by generating losses in feeder of distribution station. In addition unbalancing of power will have the effect on transformer. However DSTATCOM provides reactive power control with supply current at unity power issue. The reference supply current decide the shift of DSTATCOM where it describe the load current extraction using these techniques. STATCOM is utilized at only transmission level and therefore it control reactive power at that level only where as DSTATCOM is used at distribution level and control reactive power at loadlevel by improving voltage regulation. A DSTATCOM also can behave as a shunt active filter, to eliminate unbalance or distortions within the supply current or the provision voltage. Since a DSTATCOM is such a multifunctional device, the most objective of any management rule ought to be to form it versatile and simple to implement. the most objective of any compensation theme is that it ought to have a quick response, versatile and simple to implement. Reactive power can not be transmitted across giant power angle even with substantial voltage magnitude gradient. we are able to create many reason to attenuate reactive power transfers.

- it's inefficient throughout high real power m transfer and need substantial voltage magnitude.
- It causes high real and reactive power losses.
- It will result in damaging temporary overvoltage's following load rejections.
- It needs larger instrumentality size for electrical device and cables.

II. BASIC PRINCIPLE OF DSTATCOM

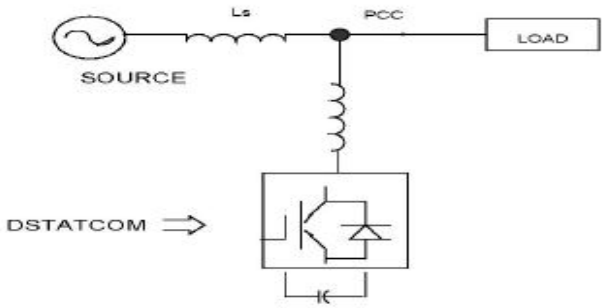

Fig 1 : DSTATCOM of Distribution System

A DSTATCOM consists of two level voltage supply device. This gadget has capacitor or battery, converter, inductor. This electrical device connects in shunt with distribution system. The voltage source converter (VSC) consists of IGBT's power electronic switches2. VSC main purpose is to act as rectifier and inverter based on requirement of reactive power. When there is demand of reactive in system then VSC acts inverter and supply power from capacitor to three phase distribution system through inductor. In this way active and reactive power is compensated in Distribution system. Alternating current line of the converter is connected to PCC via inductor. Other side DC of

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the station is attached to capacitor through conductor which is the main source of Q power storage. Farad may be charged by battery or through main source AC. When output volt of station is equal to input volt then there is no Q energy flow however when Vout < Vin Q power is pumped to AC line with respective converter volt and vice-versa.

III. CONTROL ALGORITHM

The major ideology of balancing system quantities is it should have accurate response, precise switching and proper efficiency. Algorithm is developed based on these considerations:

* Determination of system volt, Ampere and signal condition.
* Calculate compensate signal amplitude and response.
* Developing firing angle for switching devices. Generate suitable PWM firing will have high impact rate on transient and study state performance of DSTATCOM with accurate compensation. This paper presents the p-q theory with the hysteresis current controller scheme of DSTATCOM for KVAR management.

IV. P-Q THEORY

In p-q theory, 3 phase is converted to two phase system

$$v_{\alpha\beta} = v_\alpha + jv_\beta = v_a + av_b + a^2 v_c ,$$

$$i_{\alpha\beta} = i_\alpha + ji_\beta = i_a + ai_b + a^2 i_c$$

where a = exponential (2.09 i)

$$\begin{bmatrix} x_\alpha \\ x_\beta \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} x_a \\ x_b \\ x_c \end{bmatrix}$$

Where x = v or i.

Instantaneous apparent power is given as

$$\begin{bmatrix} p_{\alpha\beta} \\ q_{\alpha\beta} \end{bmatrix} = \begin{bmatrix} v_\alpha & v_\beta \\ -v_\beta & v_\alpha \end{bmatrix} \begin{bmatrix} i_\alpha \\ i_\beta \end{bmatrix}$$

compensated current at PCC voltage.

$$\begin{bmatrix} i_\alpha \\ i_\beta \end{bmatrix} = \begin{bmatrix} 1/|v_{\alpha\beta}|\cos(\omega t) & -1/|v_{\alpha\beta}|\sin(\omega t) \\ 1/|v_{\alpha\beta}|\sin(\omega t) & 1/|v_{\alpha\beta}|\cos(\omega t) \end{bmatrix} \begin{bmatrix} p_{oscl} \\ q_{\alpha\beta} \end{bmatrix}$$

Reference current generation with associated theory is shown in Figure 2.

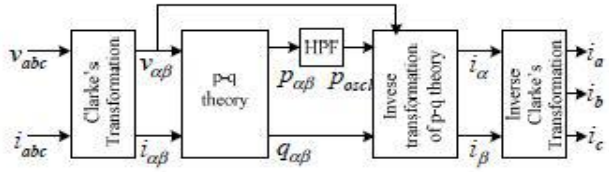

Fig 2: P-Q phenomenon algorithm mode

V. HYSTERESIS CURRENT CONTROLLER

Under hysteresis control, quick exchanging of each switch as indicated by the consistent estimation of the contrast between the DSTATCOM supply current and reference sinusoidal current. The fundamental standard of current hysteresis control procedure is that the exchanging sign are gotten from the examination of the present mistake signal with a fixed width hysteresis band. At whatever point the stage current surpasses the upper band, the upper switch of that leg will be turned ON while the lower switch will be killed. On the off chance that stage current falls underneath the lower band, the upper switch will be killed though the lower switch will be turned ON. Fig 3 demonstrates the standard of hysteresis band current controller.

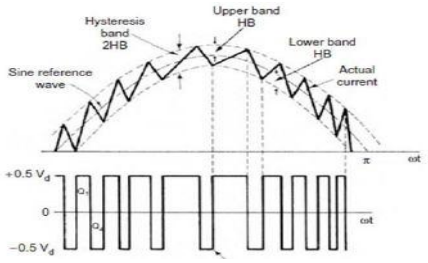

Fig 3: Phenomenal of hysteresis current regulator

VI. SIMULATION MODELS & RESULTS

Model of the DSTATCOM and its controller is created in MATLAB condition with Simulink and Power System Block-sets (PSB) tool stash. Fig.4 and 5 demonstrates the reenactment models. In fig. 6 the primary window demonstrates the waveform of dynamic power, second window demonstrates the waveform of receptive power, third and fourth window the genuine dynamic and responsive power separately. In fig.7 the principal window demonstrates the waveform of posc, third and fourth window demonstrates the waveform of heartbeats and current individually. Fig. 8 demonstrates the recreation model of hysteresis current controller and fig. 9 demonstrates the yield of with and without DSTATCOM. The pink waveform demonstrates the yield with DSTATCOM and blue waveform demonstrates the yield without DSTATCOM .

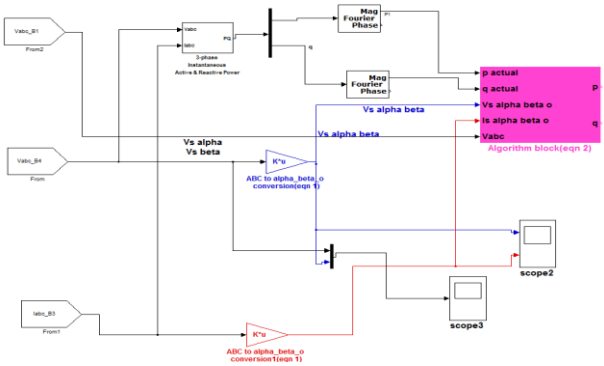

Fig:4 MATLAB Circuit .

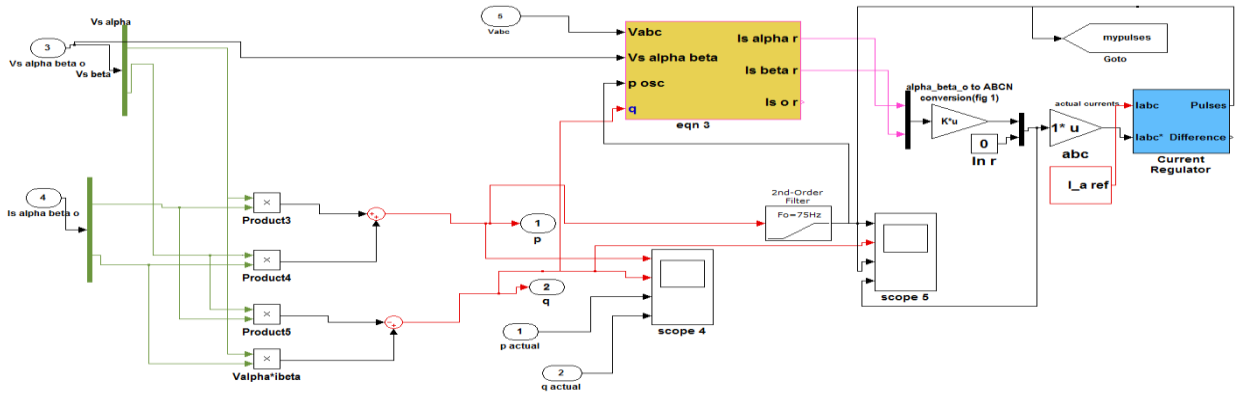

Fig.5: Simulation model

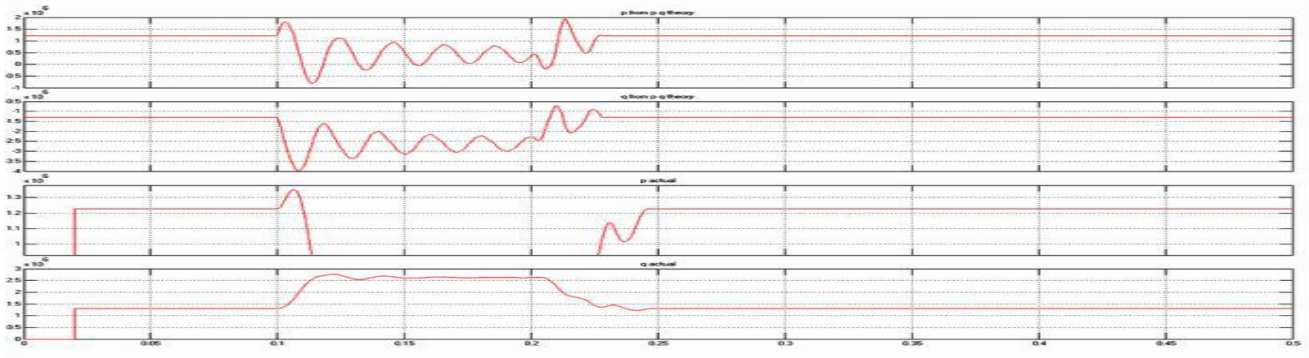

Fig 6. Waveforms

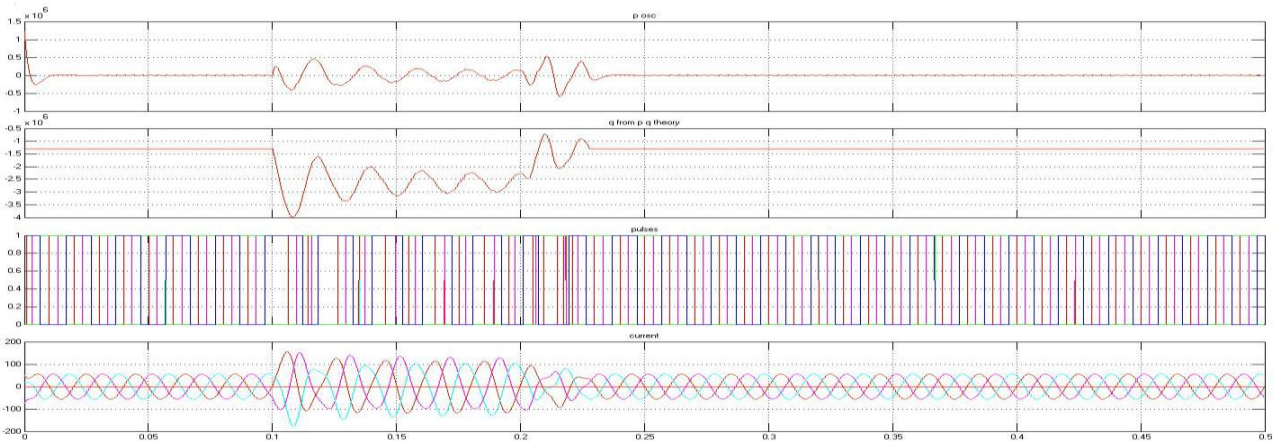

Fig 7 with DSTATCOM Signal improvement

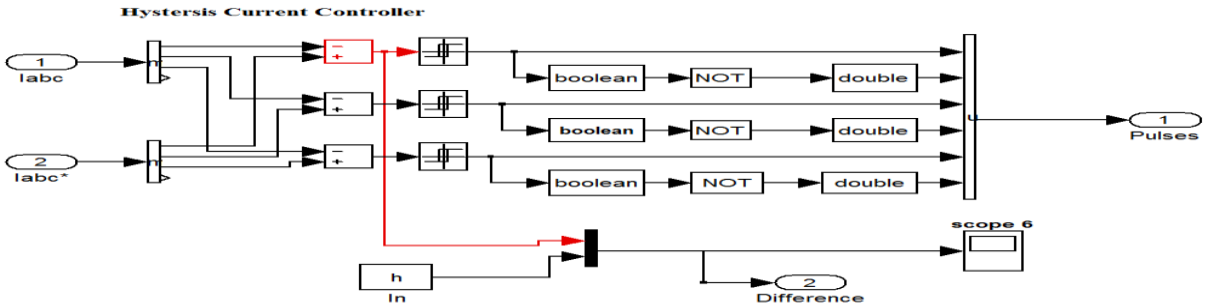

Fig 8

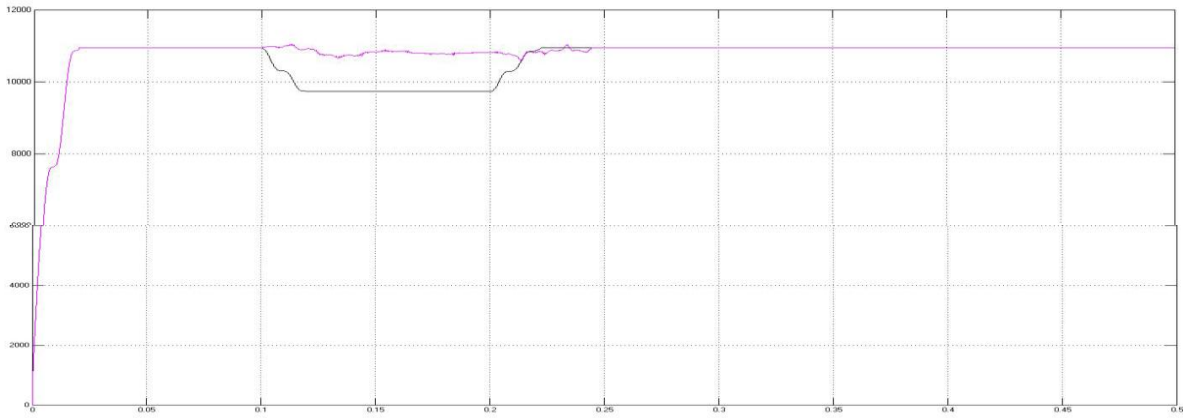

Fig 9

VII. CONCLUSION

This paper shows the investigation of DSTATCOM, p-q hypothesis and hysteresis current controller for control of DSTATCOM. The proposed control calculation of the DSTATCOM has been discovered appropriate for pay of adjusted burden. In this way, the proposed control calculation is discovered reasonable for pay method. In this manner it very well may be reasoned that DSTATCOM remunerate the responsive power in the framework.

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