UPQC IS UTILIZED TO ENHANCE POWER BY ENHANCING THE NATURE OF SUPPLY AMID THE INTERCONNECTED AND ISLANDED MODE

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Abstract- Because of huge execution of force hardware based gear power quality has transformed into fundamental and significant variable. The ordinary gadgets or hardware isn't adequate for improving the power quality. The UPQC is the new plan for further developing the power quality and also it takes care of both voltage distortion and current deformation all the while. In this paper new FACTs (adaptable Alternating current Transmission) circuit called UPQC (bound together power quality conditioner) is created to repay the voltage and current blemishes. The two distinctive control procedures are utilized for it. The voltage droop and expands along with current consonant pay are shown.

Index Terms- unified power quality conditioner, flexible ac transmission, power quality.

I. INTRODUCTION

The idea of electric inventory has a genuine effect due to extensive application of power electronics based gear. Electric power customers should be furnished with smooth continuous or undistorted stock at wanted size and recurrence. Just as the customers should draw music free current [1]. Numerous analysts are made for viable improvement of force quality. For the issues emerging in power quality, UPQC is found strong solution. UPQC is well-suited and satisfactory enough to go to supply unsettling influence like voltage, voltage swell, voltage flickering, voltage and current harmonics. The synonym of UPQC is universal active power line conditioner, universal power quality conditioner and universal active power filter. The shunt and series APF are connected in cascade through a common link dc capacitor. The series APF is coupled through series transformer to the line. The series APF prevents the source side voltage disturbances from entering into the load side to make the load voltage at desired magnitude and frequency [2]. Whereas the shunt APF connected in parallel across the load confines the current related problems to the load side to make the current from the source purely sinusoidal [3]. In this manuscript two different control schemes are used for series and shunt APF. This paper effort has been made to reduce the total harmonics distortion. Comparing paper [5], the distortion is minimized by using SPWM controller.

II. CONTROL STRATEGY

The UPQC arrangement is displayed in figure A. The UPQC comprise of two voltage source inverters associated through a typical dc interface capacitor. The voltage related issue, for example, voltage hang, voltage expand, voltage flashing and voltage sounds are repaid by series inverter associated with the line in series. The current related issues like current music are addressed by shunt inverter interface with the transmission line. The DC link capacitor connects the shunt APF and series APF together and facilitates for sharing active power among two inverter.

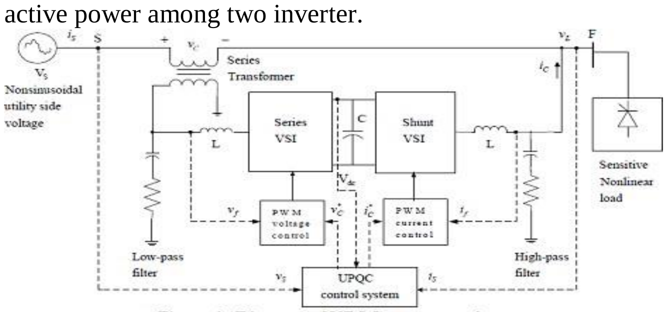

Figure 1: Diagram of UPQC representation.

1. Control Strategy I

The Series filter is controlled by simple algorithm. The unit vector template (UVT) concept is used in this paper as the control scheme [4]. From the distorted supply unit vector template (UVT) istaken. The extraction process is shown in Fig

B. objective is to make load voltage completely sinusoidal. To carry this operation the voltage opposite to distortion will be generated and it get cancels with the distorted wave, the resultant voltage will be desired voltage with exact magnitude required at load side, the load voltage will be compared with the load reference voltage and it gives error voltage signal, this signal will be fed into controller, this SPWM gives the required gating pulse to maintain power quality.

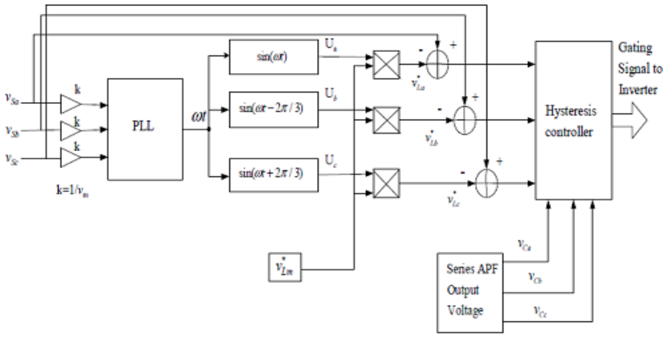

Figure 2: Control block diagram of series APF

2. Control strategy II

In the shunt active power filter uses the Instantaneous reactive power theory or p-q theory [3], to generate the reference signals. The equation (a) and the equation (b) are employed to transverse the three phase currents and voltages to α- -γ co- ordinates [3]. The shunt APF control scheme is shown in figure C.

$$\begin{bmatrix} Vi\_0 \\ Vi\_\alpha \\ Vi\_\beta \end{bmatrix} = \sqrt{2/3} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 1/\sqrt{2} \\ 1 & -1/2 & -1/2 \\ 0 & 3/\sqrt{2} & -3/\sqrt{2} \end{bmatrix} \begin{bmatrix} Vi\_a \\ Vi\_b \\ Vi\_c \end{bmatrix} \quad ...(a)$$

$$\begin{bmatrix} Ii\_0 \\ Ii\_\alpha \\ Ii\_\beta \end{bmatrix} = \sqrt{2/3} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 1/\sqrt{2} \\ 1 & -1/2 & -1/2 \\ 0 & 3/\sqrt{2} & -3/\sqrt{2} \end{bmatrix} \begin{bmatrix} Vi\_a \\ Vi\_b \\ Vi\_c \end{bmatrix} \quad ...(b)$$

The equation c depicts the computation of real power [P]

$$\begin{bmatrix} P_0 \\ Ps \\ q_s \end{bmatrix} = \begin{bmatrix} Vi\_0 & 0 & 0 \\ 0 & Vi\_0 & 0 \\ 0 & 0 & Vi\_0 \end{bmatrix} \begin{bmatrix} Io \\ Ii\_\alpha \\ Ii\_\beta \end{bmatrix} \quad ...(c)$$

ps=real power qs=imaginary power.

The equation below depicts the presences of average and oscillating components of instantaneous power.

$$Ps = \overline{Ps} + \widetilde{ps}\ ,\ qs = \overline{qs} + \widetilde{qs} \quad ...(d)$$

$\overline{Ps}$ = is the average component of real power
$\widetilde{ps}$ =is the oscillating component of real power
$\overline{qs}$ =is the average component of imaginary power
$\widetilde{qs}$ =is the oscillating component of real power.

For the power reference and current reference total imaginary power and oscillating real power are considered and used in equation (e).

$$\begin{bmatrix} I^*_{c\alpha} \\ I^*_{c\beta} \end{bmatrix} = \frac{1}{vi\_\alpha + vi\_\beta} \begin{bmatrix} Vi\_\alpha & -Vi\_\beta \\ Vi\_\beta & Vi\_\alpha \end{bmatrix} \begin{bmatrix} -Ps+Ploss \\ -qs \end{bmatrix} \quad ...(e)$$

The compensating current (Icα, Icβ) which are in α-β co-ordinate are converted into a-b-c again using the equation (f).

$$\begin{bmatrix} I^*_{ca} \\ I^*_{cb} \\ I^*_{cc} \end{bmatrix} = \sqrt{2/3} \begin{bmatrix} 1 & 0 \\ -1/2 & 3/\sqrt{2} \\ -1/2 & 3/\sqrt{2} \end{bmatrix} \begin{bmatrix} I^*_{c\alpha} \\ I^*_{c\beta} \end{bmatrix} \quad ...(f)$$

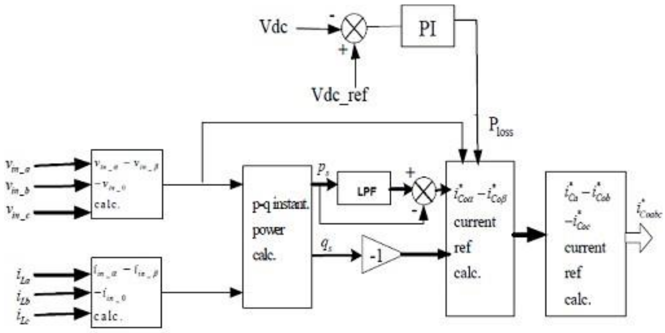

Figure 3: Control block diagram of shunt APF

III. SIMULATION RESULTS

Simulation is developed using the MATLAB/SIMULINK. To introduce the nonlinear load the three phase diode bridge is inserted in Simulink. The simulation result for voltage sag, voltage swell and current harmonics are presented.

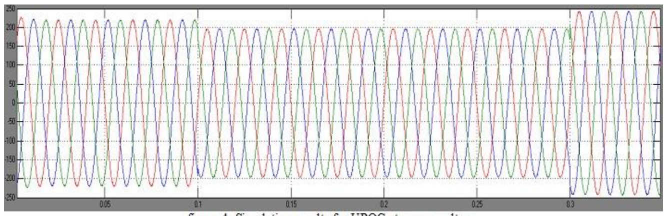
figure 4: Simulation results for UPQC at source voltage.

In the above graph the source current is shown, the source current will not have any distortion, the current harmonics problem occurs at load side, that is current harmonics is seen in load current.

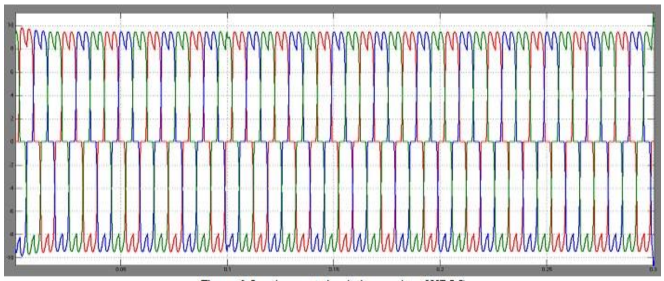
Figure 6: Load current simulation results of UPQC

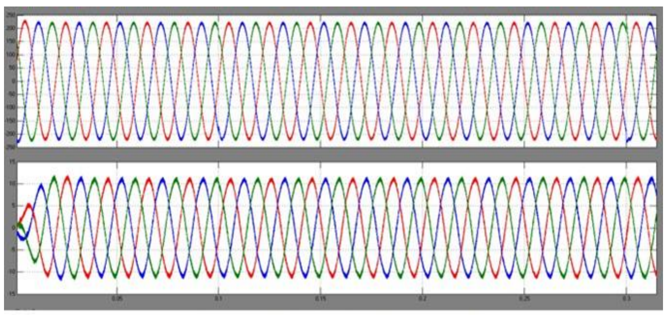
Figure 7: a) Voltage at the grid without any distortion.
b) Current at the grid without any harmonics.

The graphs shown above is the grid voltage and current when UPQC is connected to it.

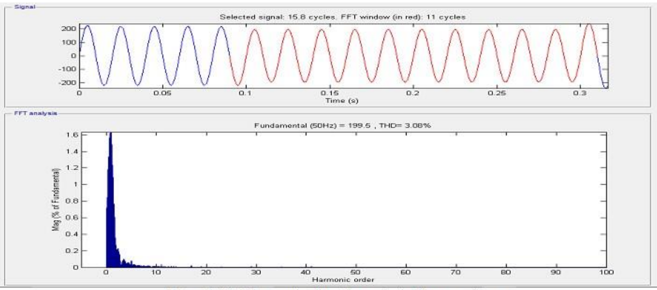

Figure 8: Total harmonics distortion analysis of source voltage

The total harmonic distortion value of the source voltage is appearing as 3.08% for 11 cycles from the start time of 0.09 sec.

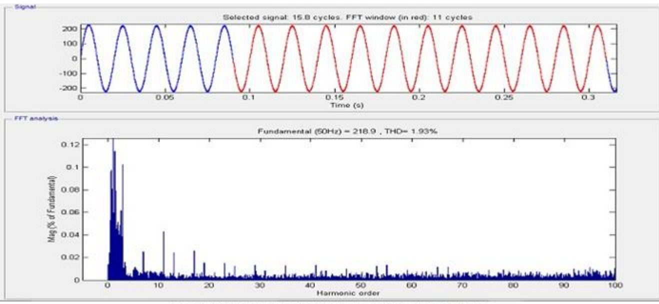

Figure 9: Total harmonic distortion analysis of line voltage

The total harmonics distortion value of load voltage is 1.93% for 11cycles from the start time of 0.09 sec. Therefore the THD of line voltage is lesser than the source voltage and it's proved that UPQC has improved the power quality

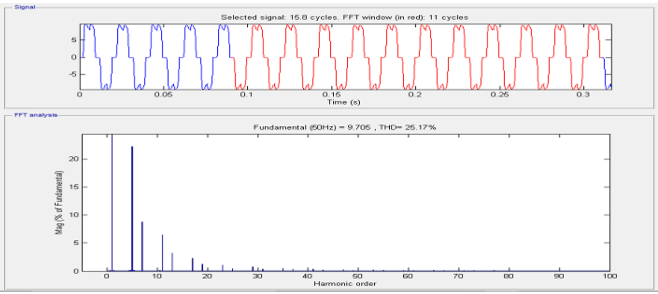

Figure 10: Total harmonic distortion of load current

The Total Harmonic Distortion value of load current is 25.17% of 11cycles from the start time of 0.09 sec.

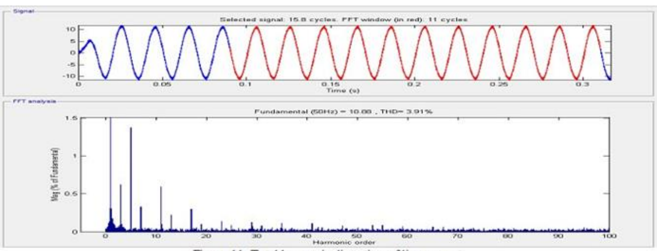

Figure 11: Total harmonic distortion of line current.

The total harmonics distortion value of line voltage is 3.91% for 11cycles from the start time of 0.09 sec. Therefore the THD of line current is lesser than the source current and it's proved that UPQC has improved the power quality

IV. CONCLUSION

This paper proposes a control calculation for UPQC dependent on SPWM voltage and current regulator. In this plan the series APF and the shunt APF of the UPQC are constrained by the blend of UVT and momentary p-q hypothesis. The UPQC model is created and simulated. It is seen from the outcomes acquired through reenactment that the inventory side voltage droop/enlarge, consonant alongside the heap side current sounds are effortlessly dealt with by the utilization of the proposed control conspire.

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