# Dual Topology of UPQC With Power Quality Improvement Using Fuzzy Logic Controller

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***Abstract***- *In grid the operation of power quality conditioner has increased during the past few years due to the constant increase of nonlinear loads linked to the electrical network. It is feasible to ensure a modulated voltage for the loads, balanced and with low harmonic distortion and at the same time leaving undistorted current from the utility grid by employing a Dual topology of unified power quality conditioner. The Dual UPQC incorporates of two active filters the shunt active filter and the series active filter. The Dual UPQC (iUPQC) is combination of two active filters, a series active filter and a shunt active filter (parallel active filter), used to terminate harmonics and unbalances. Divergent from a conventional UPQC, the iUPQC has the series filter managed as a sinusoidal current source and the shunt filter constrained as a sinusoidal voltage source. Thus, fuzzy logic controller based pulse width modulation controls of the iUPQC deal with a well-known frequency spectrum, since it is supervised employing voltage and current sinusoidal references, divergent from the conventional UPQC that is Controlled employing non sinusoidal references. This paper can establish Dual UPQC (iUPQC) for power quality improvement by considering sudden load changes.*

## I. INTRODUCTION

Due to use of nonlinear power electronics loads, like static rectifiers, variable speed drives, dc/ac converter, has produce many electric power quality problems such as high current harmonics, poor power factor and more neutral current, etc. “Power Quality is a set of limits of electrical properties that permits Electrical system to function in their intended manner without loss of performance or life”. Trouble caused by power quality can have an adverse economic impact on utilities.

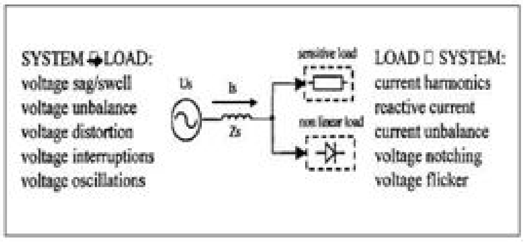


Fig.1 Power quality difficulty in a typical industrial installation

Power flow is controlled by the control actions employing FACTS devices, which incorporate (i) Static VAR Compensators, (ii) Thyristor Controlled Series Capacitors, (iii) Static Series Synchronous Compensators, (iv) Static Compensators, (v) Unified Power Flow controllers (vi) Unified Power Quality Conditioner, etc. out of these facts controller here for power quality enhancement we examine Dual topology of Unified Power Quality Conditioner.

By the use of Dual topology of unified power quality conditioners, these power quality problems can be resolved. The Dual unified power quality conditioner, which is fusion of the shunt and series active filters used to remove harmonics and unbalances.

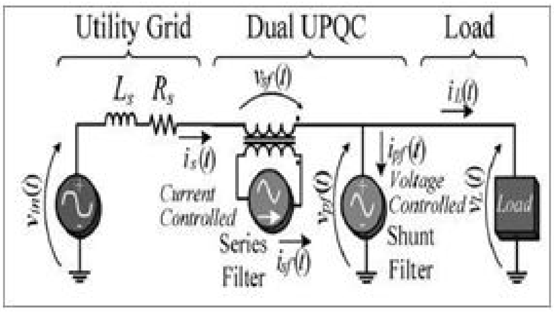


Fig.2 Dual UPQC (iUPQC)

In iUPQC, the SAF act as a current source, which deliver to a sinusoidal input current synchronized with the network voltage. The PAF works such as voltage source dignifying sinusoidal load voltage synchronized with the network voltage. Therefore, the pulse width modulation

(PWM) controls of the iUPQC deal with a well-known frequency spectrum, since it is controlled by using voltage and current sinusoidal references for both active filters.

The SAF acts as high impedance for the current harmonics and indirectly compensates the harmonics, Unbalances, and interference of the network voltage since the connection transformer voltages is equal to the distinction between the grid voltage and the load voltage. Similarly, the PAF indirectly compensate the unbalances, displacement, and harmonics of the network current, provision of a low-impedance path for the harmonic load current. By employing Dual UPQC we can separate the complex harmonic extraction of the grid voltage.

## II. OBJECTIVES OF UPQC

The main purpose of the Dual UPQC is

1) Source current linear concerning with nonlinear load
2) Constant load voltage
3) Eliminates harmonic load voltage

## IV. CONTROL SCHEMES

In the present control scheme, the power computation and harmonic extraction are not needed since the harmonics, unbalances, disturbances, displacement should be recompensed. The SAF has a current loop in order to certify a sinusoidal grid current synchronized with the network voltage. The PAF has a voltage loop in order to verify a balanced modulated load voltage with low harmonic deformation. These control loops are self-determining from each other since they act independently in each active filter

A. SAF Control: The SAF control strategy contains of three identical grid current loops and two voltage loops.

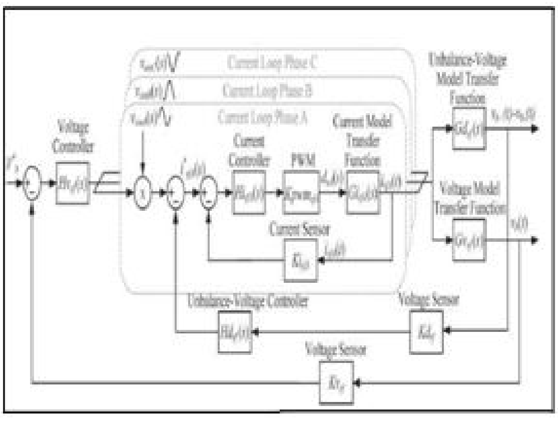


Fig.3 Control of SAF controller

When the load increases, overcoming the input grid current, the dc link provides momentarily the active power utilization, resulting in diminish of its voltage. This voltage controller proceed to raise the grid current reference, when the load diminish, the voltage controller reduces the grid current reference to modulate the dc link voltage.

B.PAF Control

Figure 4 shows the control block diagram of the shunt active filter controller. The PAF control scheme is form by three identical load voltage feedback loops; the voltage loops are liable for tracking the instantaneous voltage reference for each load output phase in order to control the load voltages separately.

The dynamic model is achieved by the circuit analysis using average values related to the switching period. Through small signal scrutiny and by employing Laplace.

The current loops are liable for tracking the reference to each grid input phase in order to control the grid currents. One voltage loop is responsible for regulating the total dc link voltage, and the other is liable for avoiding the unbalances between the dc link capacitors.

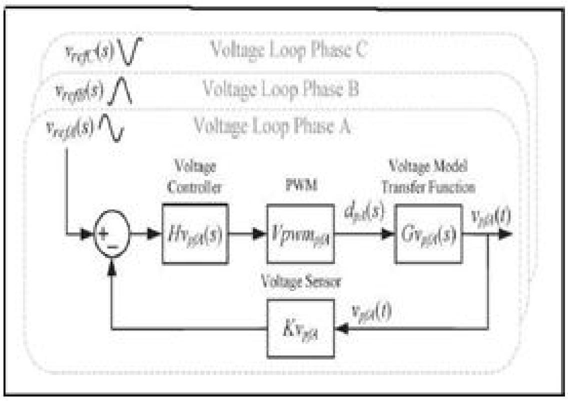


Fig.4 Control block diagram of the PAF voltage loop

## V. MODELING OF DUAL UPQC

Simulation was built in several steps from grid source to load, Dual UPQC operation at various loads is as shown in fig 5. Power Circuit of iUPQC is consist of two four wire three-phase converter connected b a c k -back and their respective output filters as shown in figure 6.

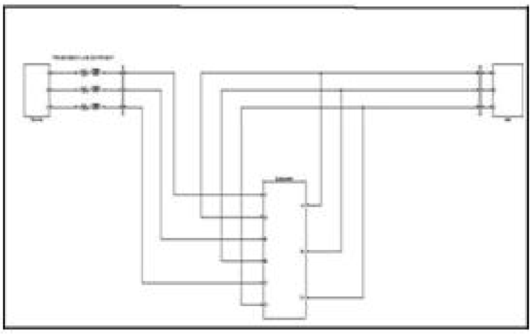

Fig.5 Simulink Design of iUPQC

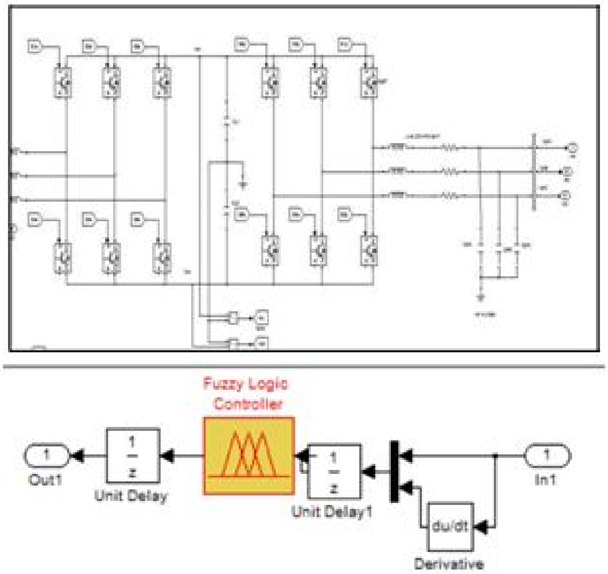


Fig.6 Power Circuit of IUPQC with fuzzy control strategy

## VI.RESULTS

The results are taken out by considering sudden changes in load conditions. Such as low voltage, rapid load step.

A. Consider three phase source voltages. Out of those three phases voltage lower accurse in phase A after two cycles and its magnitude goes to zero. But by Dual UPQC compensation modulated load voltage is taken out. Figure 7 shows the source voltage with rapid voltage deep in phase A and modulated load voltage after compensation.

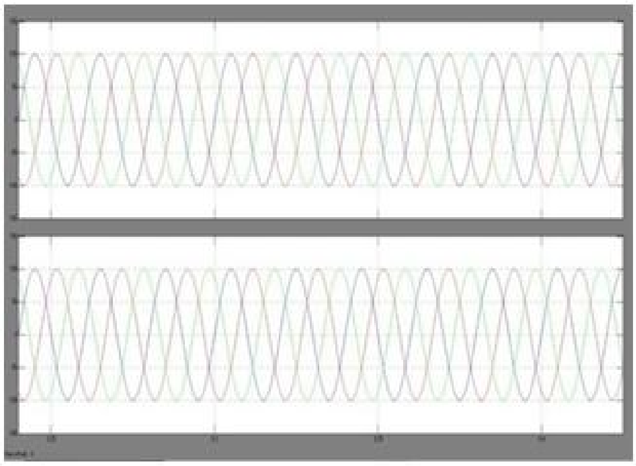

Fig.7 source voltage and load voltage during voltage dip in phase A

B. Consider a three phase source current. Out of those three phases, phase A has dip after two cycles. But by Dual UPQC compensation modulated load voltage is taken out. Figure 8 shows the load voltage and source current by considering dip in source current and modulated load voltage.

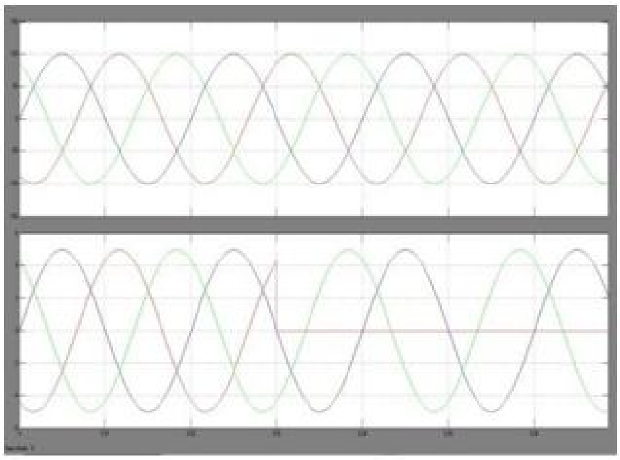

Fig.8.Load voltage and source current dip

C. Consider a three phase load current. There is immediate increase in a magnitude of current. But by Dual UPQC compensation modulated load voltage without change in magnitude is taken out. Figure9 shows the load voltage and load current by considering load current step from 50% to 100%

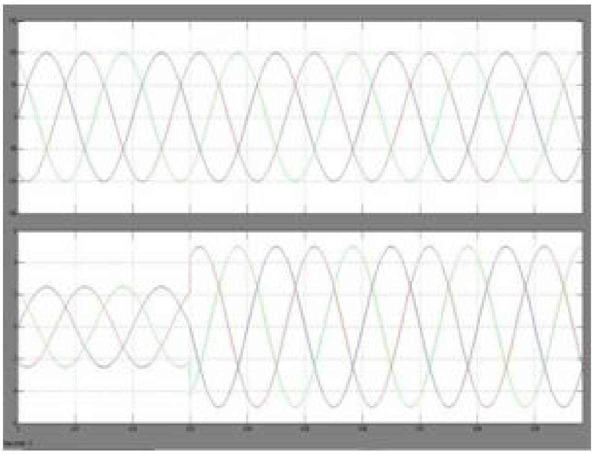

Fig.9 Load voltage and load current step

D. Consider a three load current. There is a rapid decrease in magnitude of current. But by Dual UPQC compensation modulated load voltage without change in magnitude is separated.

Figure 10 shows the load voltage and load current by considering load current steps from 100% to 50%.

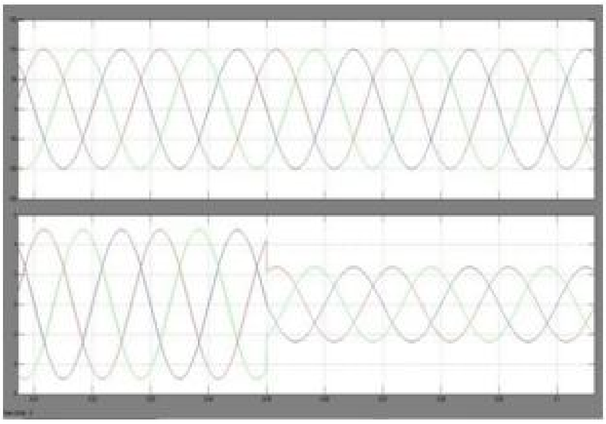

Fig.10 Load voltage and load current step

## VI. CONCLUSION

The results obtained with the iUPQC able to compensate t h e nonlinear load c u r r e n t s and also certain the sinusoidal voltage for the load in all three phases. The control also had a great operation during the load steps and voltage disturbances at the source. The main advantages of this initiate control in relation to the other proposed schemes were the utilization of sinusoidal references for both series and shunt active filter controls without the requirement of complicated calculations or coordinate transformations. By the use of Dual UPQC, it can confirm that current source linear with respect to nonlinear load, Constant load voltage; this model Eliminates harmonic load voltage.

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