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ENHANCEMENT OF POWER QUALITY USING UNIFIED POWER QUALITY CONDITIONER

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ABSTRACT

In the modern power system the usage of power electronics loads are relatively high and it behaves as non-liner load. This load causes the serious voltage distortion and power quality issues on the transmission and distribution system by injecting the harmonics. The active power filters is used to regulate this problem. Unified power quality conditioner is the combination of series and shunt active power filters.it not only eliminate the harmonics, also it treat all type of voltage and current fluxuations and compensate the reactive power in distribution system. In this paper unified power quality conditioner with different control strategy is introduced to rectify the power quality issues and increase the efficiency of power quality. UPQC concern feedback system with PI controller is used to improve the performance of UPQC and compare the different strategy using MAT LAB/SIMULINK.

KEYWORDS: Power Quality, APF (active power filters)

I.INTRODUCTION

In general the power system consists of generation transmission and distribution. Apart from that generation, the transmission and distribution have the major problem called power quality issues. The power quality issues are voltage sag, voltage swell, interruption, harmonics, flickers etc. now a days we frequently using the many sensitive loads such as computer, led television etc. Due to poor power quality such equipment may failure. To diagnose this problem and also to improve the power quality we have only solution, called unified power quality conditioner.

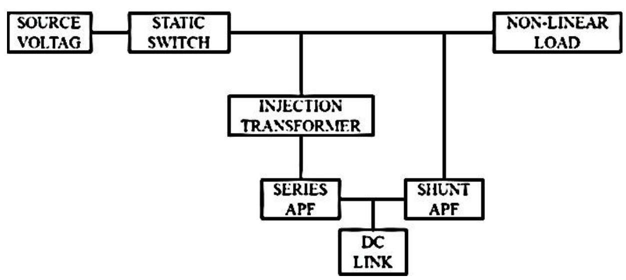

Fig: 1 Block Diagram of UPQC

From the block diagram the UPQC consist of two components named series active power filter and shunt active filter. It is also equalized with the DVR and D-STATCOM. The performance of voltage controlled voltage source inverter is acted as series active power filter, and the performance of current controlled voltage source inverter is acted as shunt active power filter. The both series active power filter and shunt active power filter are coupled with dc capacitor for dc link. The series APF is connected via an injection transformer with

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the ac line. The isolation of voltage based distortion is done by the series APF and the isolation of current based problems is done by the shunt APF. Also it treats the reactive current of the load and improves the power of the system.

A.SERIES ACTIVE POWER FILTER

The series APF is a series element which can act as a controlled voltage source. It gives voltage of negative polarity harmonics by injection transformer. The basic circuits of series APF is shown in figure.

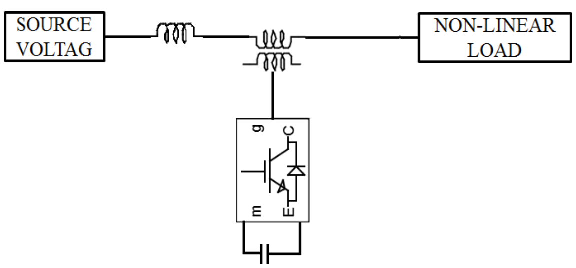

Fig: 2 Series Active Power Filter

The capacitor is energy storage wit self-supporting that is with reactive power exchange. If we use constant dc source then there exists only a real power exchange through voltage source inverter

B.SHUNT ACTIVE POWER FILTER

Shunt active power filter is a shunt connecting device which can be acts as controlled current source. It gives opposite current harmonics to clear current related problems. The performance of dc capacitor is same as the series APF. The basic circuit configuration shunt APF is shown in figure.

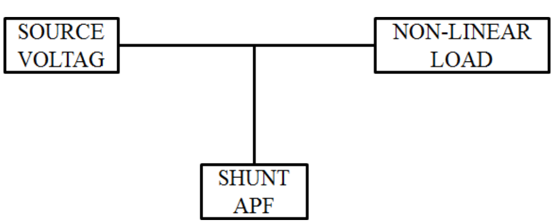

Fig: 03 Shunt Active Power Filter.

The function of shunt APF is dc link voltage regulation improvement of power factor by controlling reactive power.

II. DIFFERENT CONTROL STRATEGIES

In this paper there are three different control strategies are explained and compared by its simulation results. The various strategies are

1) A normal transmission line with source side and load side. To check its performance under 3 phase fault condition using mat lab/simulation. Here the line supply voltage is taken as 400v for each phase for injecting the harmonics we considered the RL load with the resistance value of 30Ω and the inductance value of $10e^{-3}$H
2) Transmission line with unified power quality conditioner is considered here the line supply voltage is take as 400v fir each phase for providing the harmonics we considered the RL load with the resistor value of 20Ω and inductor value of $50e^{-3}$H
3) Here the transmission line is operated through the UPQC with PI controller is introduced. The line supply voltage is 400v and resistor is considered as the non-linear load valued300Ω.

III. DESIGN OF CONTROLLERS

The use of power electronic controller in the electric power supply system has become very common. The controllers are used to improve the performance of the system with the help of feedback. The controller is applicable only for the closed loop system.

A.OPEN LOOP SYSTEM

The function of any electronic system is to automatically regulate the output and keep it within the systems desired input value or fixed point. If the

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system desired input value or any other reason, the output of the system must respond accordingly and change itself to reflect the new input value. Likewise, if something happens to disturb the systems output without any change to the input value, the output responds and returning back to its previous set value. The electronic system was basically controlled only manually called open loop control system.

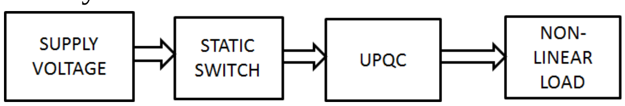

Fig: 04 Block Diagram of Open Loop System

B.CLOSED LOOP SYSTEM

The systems in which the output quantity has no effect upon the input to the control process are called open loop control systems, and the open loop systems are just that named non feedback systems. But the goal of any power system control is to measure, monitor, and control the process. One way in which we can obviously control the process is by monitoring its output and –feeding‖ some of it back to compare the actual output with the desired output so as to reduce the error, if the system disturbed then the output of the system back to the original or desired response. The measure of the output is known as feedback signal and the type of control system which uses feedback signals to control itself is called a Close-loop System.

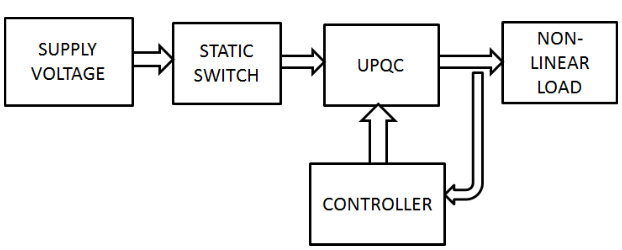

Fig: 05 Block Diagram of Closed Loop System

C.PI CONTROLLER

A PI controller calculates an error value as the difference between a measured process variable and desired set point. The controller attempts to reduce the error by adjusting the process control inputs. V_{dc} is sensed and compared with its reference V_{dc}*. Error signal is processed in a PI controller. The output of the PI controller is expressed as $I_{sp(n)}$. The output of controller has a limit ensures that the source provisions active power of the load and dc bus of the UPQC .A self-supported dc link of the UPQC is supplied by the active power. Thus, the dc voltage of the UPQC has a proper current.

IV. PERFORMANCE ANALYSIS OF UPQC

A. TRANSISSION LINE WITH POOR POWER QUALITY

In this paper first we are going to analyse the performance of transmission system without unified power quality conditioner. As the resulting leads the severe voltage distortion and losses. The mat lab simulation is analysed by following.

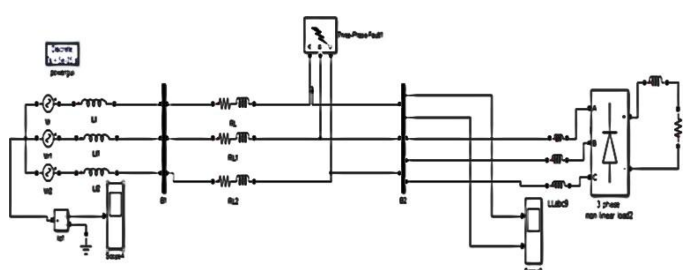

Fig 7: Transmission Line

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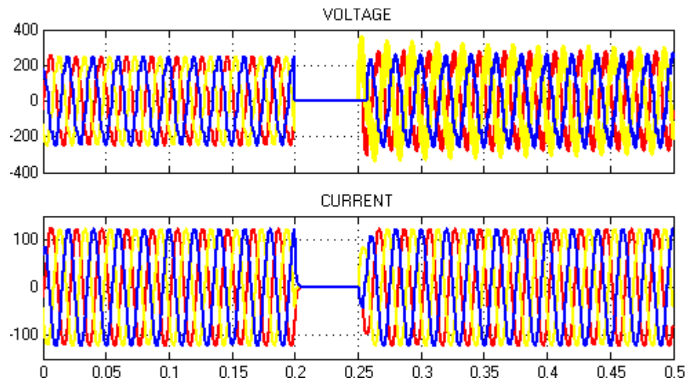

Fig 8: Output waveforms for transmission line

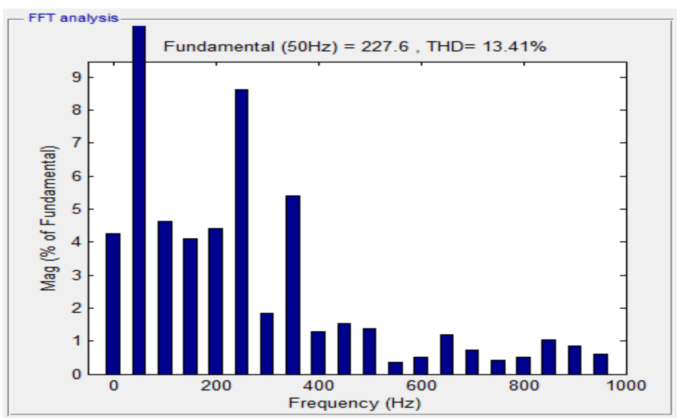

Fig 9: FFT Analysis for the transmission line

B.TRANSMISSION LINE WITH UPQC

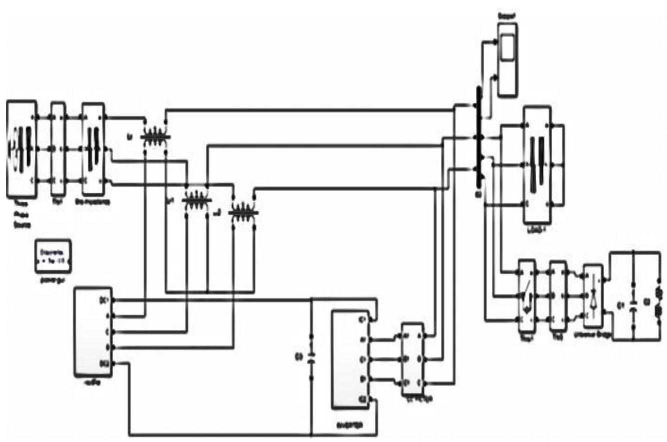

Fig 10: Transmission Line with UPQC

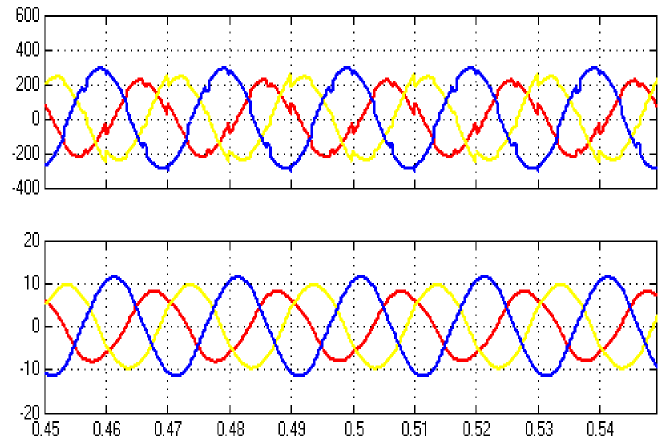

Fig 11: Output waveforms for with UPQC

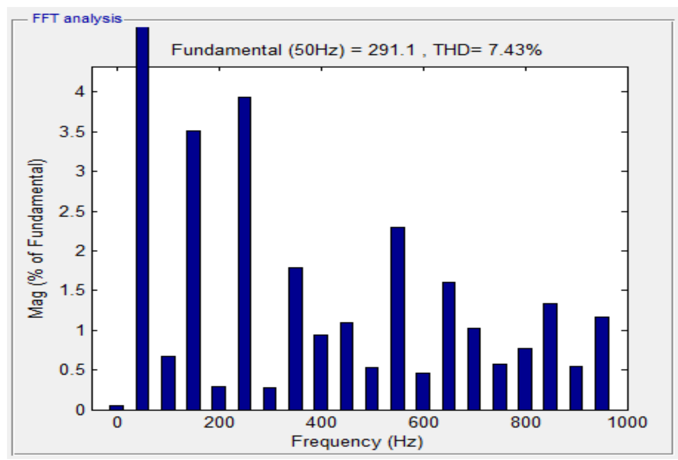

Fig 12: FFT Analysis for with UPQC

C. UPQC WITH PI CONTROLLER

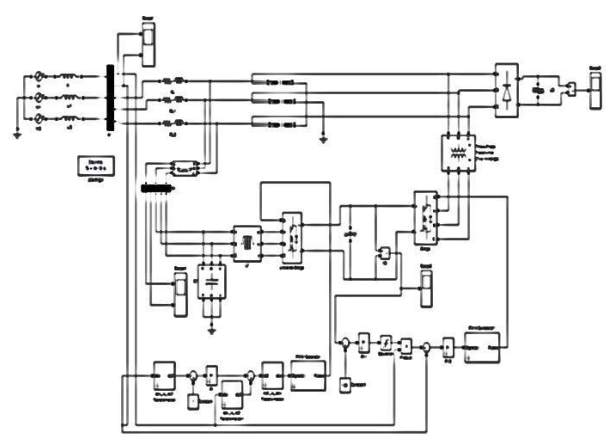

Fig 13: UPQC with PI Controller

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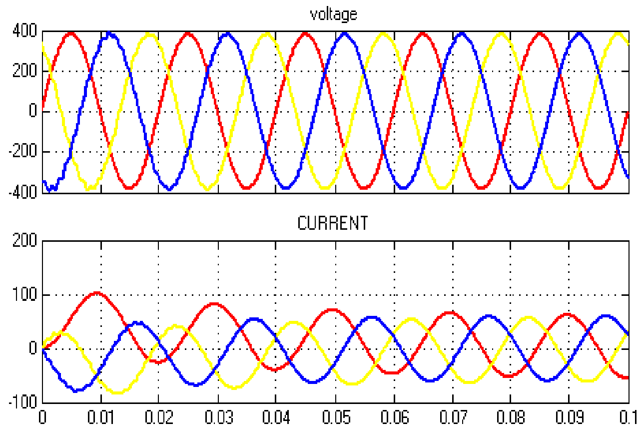

Fig 14: Output Waveforms for UPQC with PI

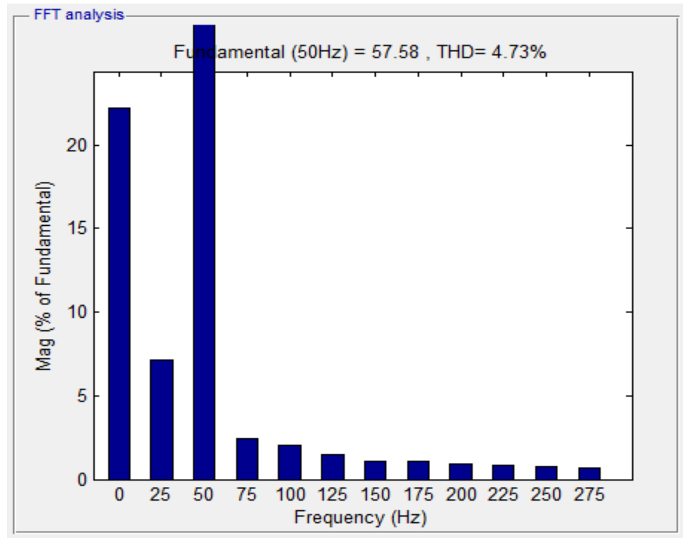

Fig 15: FFT Analysis for UPQC with PI

CONCLUSION

The different control strategy of UPQC was described and compared its performance using simulation. The power quality issues are almost reduced. The closed loop control schemes of current control, for the proposed UPQC have been investigated. Total harmonic distortion was analysed and that describes that the UPQC with PI controller provides more efficiency than the other strategies.

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