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POWER QUALITY IMPROVEMNET BY USING THREE PHASE FOUR WIRE UPQC

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Abstract – *The present research is incorporation of series (APF) as well as shunt dynamic power filter (SAPF) connected with a DC interface voltage. In this series converter is utilized to control current source whereas parallel converter works as voltage source. The demand of power quality (PQ) change has been creating in the continuous years as a result of addition of non-direct loads associated with the electrical power systems causing twists in the utility voltages.. The present study is about the analysis, practical implementation of a UPQC which is connected to 3-phase 4-wire(3P4W). The UPQC can complete power line and compensation for introduced loads that require an unbiased conductor to work. Various steps of control procedures utilized in the most UPQC application. In this voltage source inverter 4-leg based topology of 4-wire UPQC is analyzed. The execution of every topology of this device is assessed for various PQ issues for instance voltage harmonic alleviation, source unbiased current lightening, current harmonic alleviation, and power-factor rectification. The point of this device is to compensate stack current and supply voltage. Converter and control examination is presented together with the results showing the ways of operation. For better power quality enhancement PIC controller is utilized instead of PI controller and thereby results are verified. The proposed technique empowers that UPQC is to compensate current harmonics, voltage drops/swells and voltage unbalances can likewise impact the correct activity of sensitive equipment causing breakdown and thus by resolving the circuit in MATLAB Simulink.*

Key Words: PQ, UPQC, 3P4W, PI.,

1. INTRODUCTION

UPQC technique with reduced DC-connect voltage proposed in this work. The inductor of shunt active filter is connected in series with capacitor. The series capacitor will engages us in the chopping of DC-interface voltage requirement of the shunt dynamic filter and at the same time it gives the open power required by the load in the system. This will maintain power factor in the system, without compromising the performance of the series capacitor. . This will empower the DC voltage requirement for shunt and series filters in the UPQC with a DC capacitor. Further, in this proposed strategy the fourth wire neutral is to be connected with negative terminal of the DC bus will wipe out the need of the additional leg in VSI of the SAF of UPQC therefore and furthermore helps the control of leg in the shunt VSI as free of UPQC with a DC capacitor.

There are different methods were stated in the literature of 3-phase 4-wire UPQC for using active alternative for the minimizing source current of neutral along with the other PQ problems. For the minimizing source current of neutral, the utility of passive elements is helpful than the active alteration due to low ruggedness. There are lot of ideas proposed for the compensation of neutral current such as using a star-delta transformer in the three-phase four-wire distribution system and some of these have been limited. The use of transformer with star- delta connection along with APF is used for the reducing of harmonic present in the current in the neutral. A filter operated with a 3 single-phase transformer with the capacitor been used for eliminating harmonic current from the neutral conductor and has limited. Another method by involving a 6-phase system, with the help of transformers which are connected in opposite-phase has been described for eliminating third harmonic power in the neutral. The transformer along with a full-bridge PWM inverter and a rectifier is also investigated for the compensation of current neutral. For the elimination of neutral current with some other current based disturbance, alongside of readily available 3-leg VSI with transformer of star-delta has been analyzed in the literature of 3P-4W DSTATCOM. Unfortunately, for the elimination of current neutral the performance of transformer with star delta combination is affected to an level under unbalanced source voltages, which is common.

1.1 PROBLEM ANALYSIS

There are two types of voltage variation in power system one is short duration voltage system and another is long duration voltage system

The Short Duration Voltage Variation is less i.e. under 1min.The fundamental explanation behind this are-extensive load energisation, fault conditions

and so on. Short duration voltage variety incorporates Voltage drop, voltage swell and interference.Long duration voltage variation are underovltage, overvoltage and sustained interruptions

Voltage Swell: It's the expansion in the line-voltage (rms) to 1.1-1.8% of the ostensible line-voltage for a small time of half cycle to 1 min. Fundamental driver for this is Swells can be turning off of a substantial load.

Voltage Sag: It's a lessening in the line voltage (rms) to 10 to 90 % of the standard line- voltage for a time of half cycle to a min. It is additionally eluded as "dip". The fundamental driver for this voltage droop is beginning of huge enlistment engines.

Interruption: It's the decrease in current or line-voltage to an esteem which is under 0.1 pu for a length not in excess of 1 min.

Under Voltage: A decrease in the root mean square air conditioning voltage to esteem not exactly even 90 %. Its range is minimal in excess of a min. The fundamental purpose behind this overvoltage is turning off of the capacitor bank.

Overvoltage: It's an ascent in the root mean square air conditioning voltage to esteem in excess of 110 %. Its is additionally more prominent than a min. Primary driver for this overvoltage is stack exchanging.

Sustained Interruptions: It is the circumstance when supply voltage is zero for a time span outperforming a moment.

2. UPQC

In the present system control hardware based devices have been able to be the most basic part. They have a various points of interest yet then again they additionally indicate numerous lacunas. They draw harmonic current alongside the major power recurrence which contains the dispersion system. The main objective to give particular responses for the new troubles constrained on distribution system, the idea of the flexible AC transmission systems (FACTS) has been incorporated. These FACTS devices use to update the controllability and to construct control trade capacity of the transmission system. Two strategies are there for the control of responsive and dynamic power one uses conventional thyristor exchanged capacitors (TSC) and thyristor switched reactors (TSR), Both the plans help to beneficially control the reactive power, the second one can be used to compensate current and voltage harmonics. In addition, self-commutated exchanging converters present a predominant reaction time and more compensation flexibility.

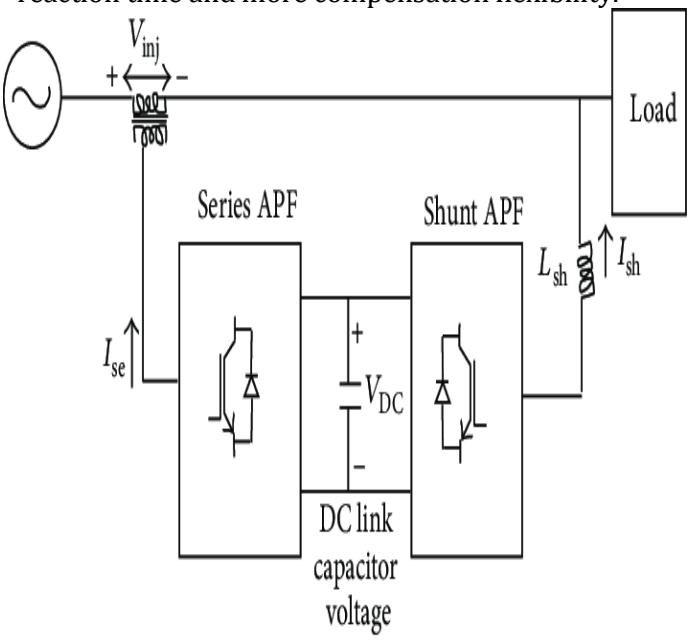


Fig -1: Basic diagram of UPQC

3. RESEARCH METHODOLOGY

The Unified Power Quality Conditioner (UPQC) is used to improve power quality in a three-phase, four-wire distribution system. Generally, some topologies applied for three-phase, four-wire UPQC use active compensation for the mitigation of source neutral current along with other power quality (PQ) problems, while the uses of passive elements for the mitigation of source neutral current are advantageous over the active compensation due to ruggedness and less complexity of control. Upqc is a combination of shunt (STATCOM) and series (DVR) compensators as a single solution for mitigating these multiple PQ problems of voltage and current. For voltage sag/swell/ Harmonics problems the series DVR is used while as for unbalanced loads the shunt is used to compensate the load. The controller used in our system is Fuzzy logic interface with PI controller .

This proposed system has all the advantages of general UPQC, in addition to easy expansion of 3P3W system to 3P4W system. Thus, the proposed topology may play an important role in the future 3P4W distribution system for more advanced UPQC based plant/load center installation, where utilities would be having an additional option to realize a 3P4W system just by providing a 3P3W supply.

Hence, in this thesis a star-delta transformer is connected in shunt near the load for mitigation of source neutral current, while three-leg voltage source inverters (VSIs) based shunt and series active power filters (APFs) of three-phase UPQC mitigate the current and voltage based distortions, respectively. Electrical grid systems have a limited amount of real-time maintaining system including demand supply, voltage etc. some of the issues in voltage maintaining is sag and swell. For this purpose we work on the model to maintain the load by removing the sag/ swell and harmonics. The results are very encouraging in terms reduce sag and swell. Simulation is analyzed and verified by MATLAB 2013 Simulink software. Fuzzy logic control basically relies on the guidelines shaped by the Semantic factors.

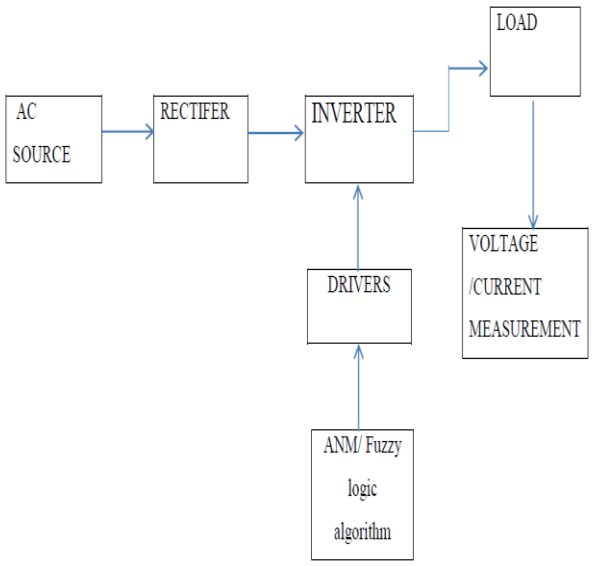


Fig-2:- Block Diagram of Proposed Work

4. RESULTS AND DISCUSSIONS

In this we are using alternating signals they starting from zero and reaches maximum and again drops to zero so we have to take mean values

STEP 1: Double click on the current scope; the following graphs will be displayed.

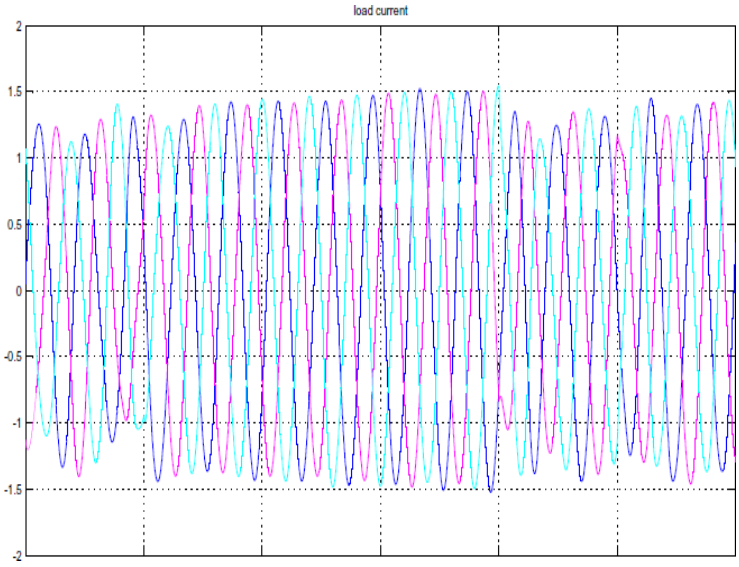


Fig-3:- Load Current graph

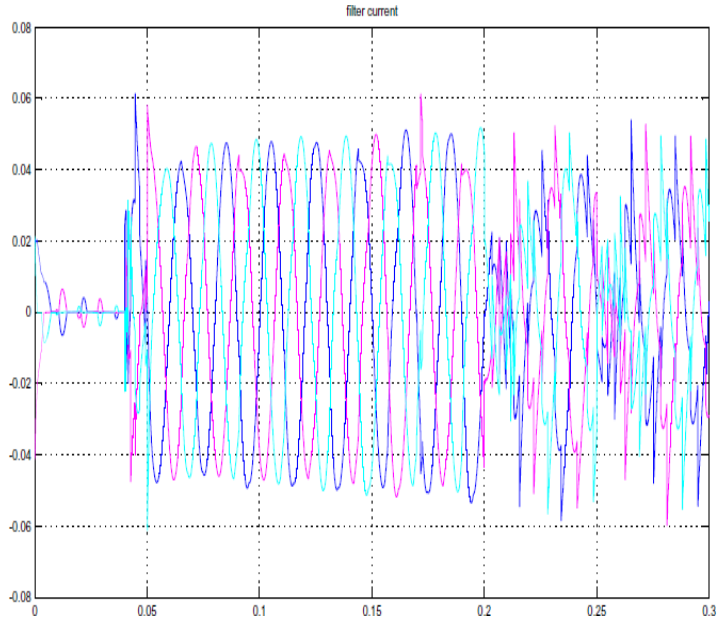
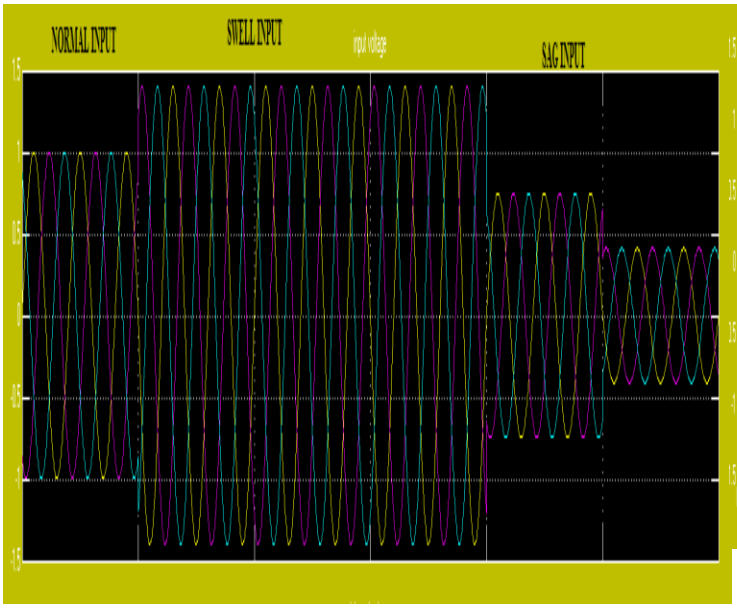


Fig-4:- Filter Current Graph

STEP 2: To maintain the voltage i.e. sag/ swell, double click on the scope 2 the sag/ swell graph will be displayed as



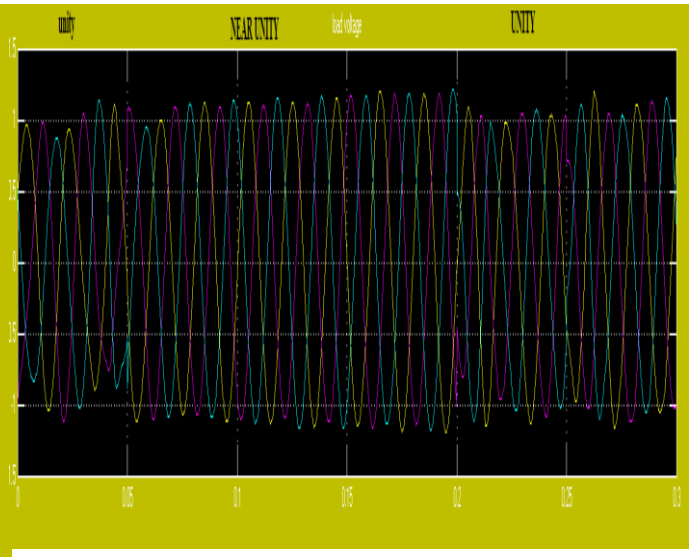


Fig-7:- Output Voltage

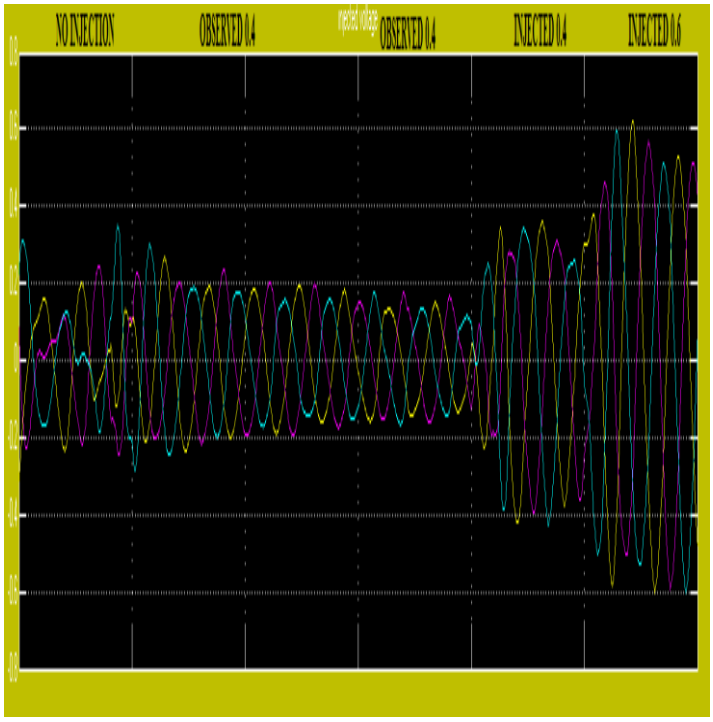


Fig-5:- Input Voltage

Fig-6:- Injected Voltage

STEP 4: Instantaneous power by using Clark's transformation

From the ist graph it shows the voltage profile and the second graph is current graph vs Time

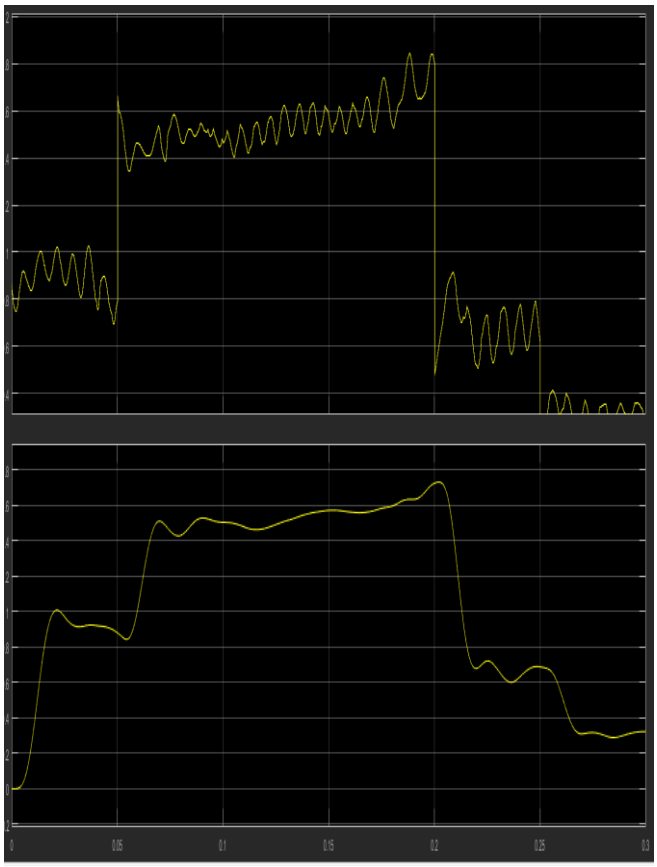


Fig-8:- Instantaneous Power

STEP5: COMPENSATING CURRENT TRANSFORMATION BY USING INVERSE CLARKS TRANSFORMATION

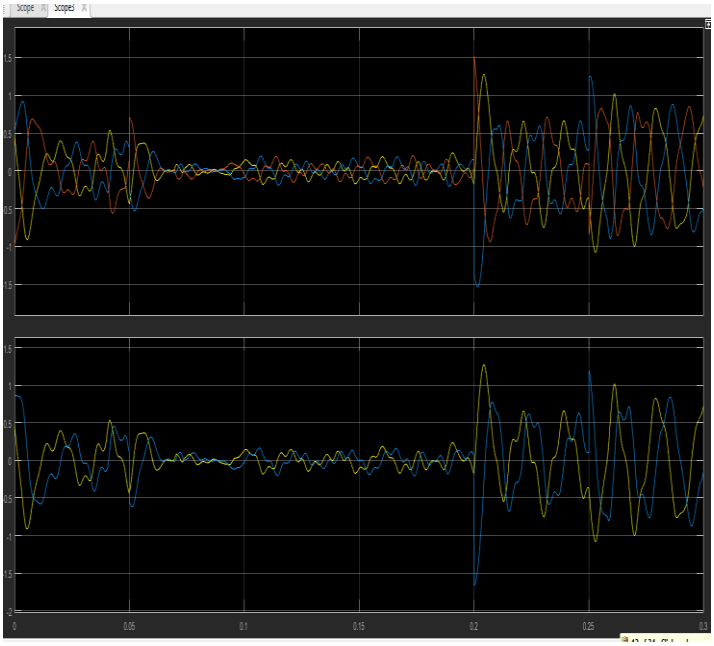


Fig-9:- Compensating current

5. CONCLUSION

Based on the UPQC topology have been proposed in which the capacity to compensate the voltage swells, voltage sage and current harmonics at the load at a lower DC-interface voltage by utilizing distinctive control systems for series and shunt APF's.In addition to this, it has also been found that the 4- wire shunt APF topology compensates for the current distortions irrespective of whether the series APF is switched 'on' or 'off'. On the other hand in case of star-delta transformer and/or zig-zag transformer topology, the mitigation of neutral current is only possible if the voltages across these transformers are sinusoidal. In other words the series APF should be switched 'on' along with the shunt APF for neutral source current mitigation by zig-zag or star-delta transformer supported UPQC configurations. The simulations results demonstrates that the misshaped and uneven stack loads seen from the utility side acts as perfectly adjusted source currents and are free from mutilation.

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