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Conditioning of Power Quality by the aid of UPQC in Distribution System

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ABSTRACT: Present days power quality is a major challenge for distribution companies because of continuously varying loads on consumer side, here we are dealing with sophisticated techniques to improve power quality issues like load balancing, correction of power factor, voltage regulation, voltage and current harmonics reduction, mitigation of voltage sag, swell and voltage dip in three phase three wire distribution system, which handling both linear and non linear loads. Here we are mainly using unit template technique (UTT) to obtain reference values for cascade active power filter (APC), at the same time the calculation for parallel APF uses two closed loop fuzzy based PI controller with the help of controller algorithm. Shunt APF is more flexible to correct power factor, harmonic elimination, load balancing. Furthermore, with improve the load terminal voltage of point common coupling (PCC) simulation results were compared with various power quality equipment with the support of UPQC efficiency.

KEYWORD: Power Quality improvement, UPQC, Harmonics elimination, Load Balancing, Power Factor improvement, voltage swell, voltage sag, MATLAB/SIMULINK.

I. INTRODUCTION

To supply continuous sinusoidal voltage of steady extent to their customers is the principle goal of electric service organizations. Be that as it may, this is getting to be dull step by step due to the expanded utilizations of intensity gadgets based machines at local and mechanical purposes. These nonlinear burdens draw non-straight flow and debase electric power quality. The quality debasement prompts low power-factor, low effectiveness, overheating of transformers, etc. Aside from this, on an appropriation framework the overall heaps is not really discovered adjusted. Due to expanded uses of modern and further developed programming and equipment for the control frameworks, the power quality has made sense of the most significant issue for power engineers. Before, uninvolved channels were utilized to relieve these recognized power quality issues. Be that as it may, the impediments related with detached channel, for example, fixed remuneration, reverberation with the source impedance and the trouble in tuning, time reliance of channel parameters have constrained the need of dynamic and mixture filters. These channels address just few distinguished power quality issues of the present conveyance systems. Identifying with power quality issues, the fashioners of Power Quality Conditioner Systems are required to pursue the suggestions of some worldwide acknowledged gauges like IEEE-519-1992 prescribed practice and prerequisites for symphonious control in electric power frameworks.

For the moderation of various power quality issues looked by the present power dispersion frameworks, another innovation called custom power emerged. The CP gadgets are material to appropriation frameworks for upgrading the dependability and nature of the power supply. The remunerating type custom power gadgets for the most part covers the shunt associated gadget called DSTATCOM , arrangement associated gadget called DVR and blend of arrangement and shunt associated gadget called UPQC . For the most part, the DSTATCOM deals with the current based bends, while DVR is utilized for the alleviation of voltage based twists. The Unified Power Quality Conditioner (UPQC) is one of the key CP gadget, which repay both current and voltage related issues, at the same time. As the UPQC is a mix of consecutive associated arrangement and shunt APFs to a typical DC connect voltage, two APFs have various capacities.

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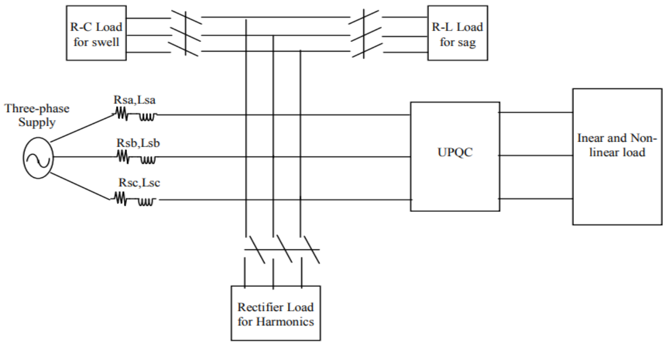

Fig.1 System under consideration

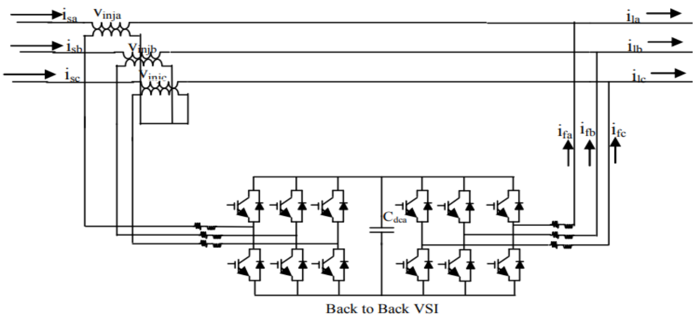

Fig. 2 UPQC Block Diagram

There are many control methodologies detailed in writing to decide the reference estimations of the voltage and the current, the most widely recognized are the quick dynamic and receptive power hypothesis (the p-q hypothesis) proposed by Akagi, symmetrical part change, synchronous reference outline hypothesis (SRFT), and UTT and so on. In the present work UTT based methodology is utilized for the control of UPQC for the moderation of various power quality issues. These issues are burden adjusting, control factor redress, voltage guideline, voltage and current harmonic moderation, alleviation of voltage droop; swell and voltage plunge in a three-stage three-wire conveyance framework. This extensive exhibition examination of UPQC is focal point of the paper. The UPQC setup and the heap under thought are examined in area II. The control calculation for UPQC is talked about in area III. The SIM POWER SYSTEM (SPS) Matlab/Simulation based recreation results are examined in area IV lastly segment V finishes up the paper.

II. SYSTEM DISCRIPTION

The framework under thought is appeared in Fig.1.The UPQC is associated before the heap to shield the heap from any voltage based twists and simultaneously, to make the source flows sinusoidal, offset and in stage with the source voltages. Arrangements are made to acknowledge voltage sounds, voltage hang and swell in source voltage by exchanging on/off the three-stage rectifier load, R-L burden and R-C load, separately. So as to make a voltage plunge in source voltage an acceptance engine is associated all of a sudden on the heap side. The UPQC is acknowledged by utilizing two voltage source inverters (VSIs) associated consecutive with a typical DC connect voltage, is appeared in Fig.2. One VSI going about as a shunt APF, while the different as arrangement APF. Each APF is acknowledged by utilizing six Insulated Gate Bipolar Transistors (IGBT) switches. The (isa, isb, isc), (ila, ilb, ilc) and (ifa, ifb, ifc,), represent the source flows, load flows and shunt APF flows in stage a, b and c individually. The infused voltages by the arrangement APF in stage a, b and c is spoken to by (vinja, vinjb and vinjc), individually. A three-phase R-L load is taken as linear load, where as a three-phase diode bridge rectifier with a resistive load on dc side is considered as a non-linear load.

III. CONTROL STRATEGY OF UPQC

The proposed control procedure is expected to produce reference signals for both shunt and arrangement APFs of UPQC. A methodology dependent on UTT is abused to get reference voltage signals for the arrangement APF,

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where as the control system for shunt APF uses two shut circle PI controllers. The reference voltage age for arrangement and shunt APF is appeared in Fig.3.

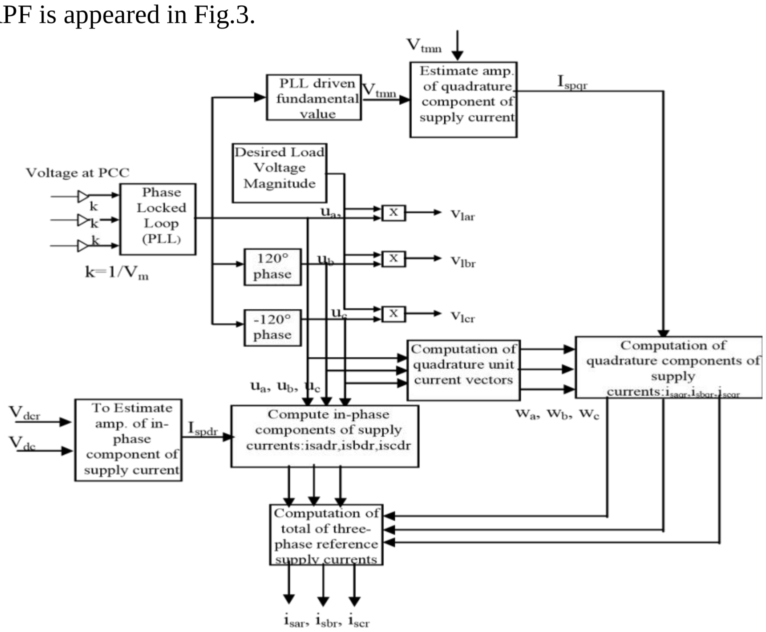

Fig. 3 Control Strategy of UPQC

IV. SIMULATION BLOCK DIAGRAM

The model of UPQC and the proposed control plot in the MATLAB/SIMULINK condition is appeared in Fig.4. The exhibition of UPQC is assessed as far as voltage and current harmonic alleviation, load adjusting, power factor correction, mitigation of voltage sag, swell and voltage dip under different load conditions.

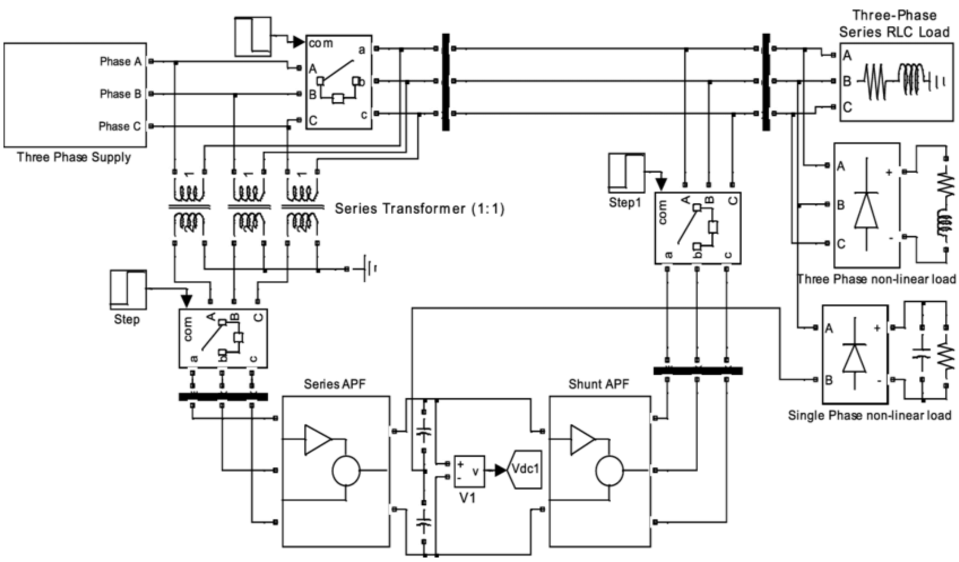

Fig. 4 MATLAB model of UPQC

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V. SIMULATION RESULT ANALYSIS

(i). Performance of UPQC for load balancing and power factor correction

Fig. 5 demonstrates the reaction of UPQC with direct slacking force factor load for power-factor adjustment and burden adjusting. The shunt APF was put into task at 0.1 sec. Fig.5 (e) demonstrates that after 0.1 sec the source voltage and source current in stage 'an' are actually in stage. At t=0.2 sec the heap is changed from three stage to two stage to make the heap unequal. The shunt APF makes up for the uneven burden and source flows are as yet offset and in stage with the source voltages. It is likewise seen from Fig.5 (f) that during unequal burden activity, the dc voltage increments and settles to it past unfaltering state esteem, when burden is adjusted.

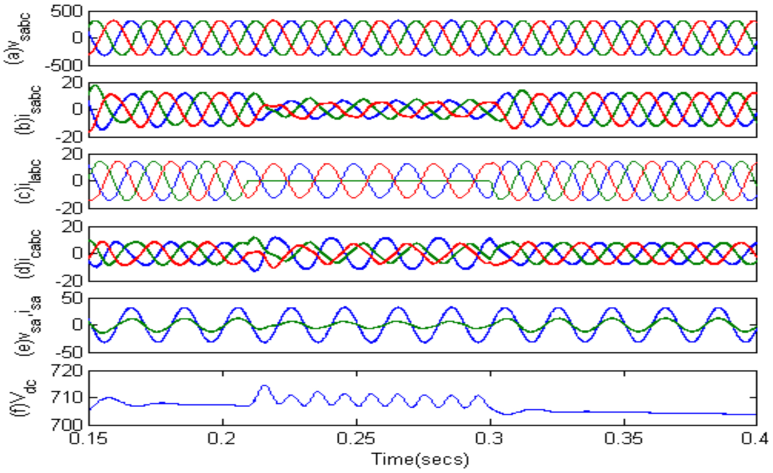

Fig. 5 Performance of UPQC for load balancing and power factor correction

(ii). Performance of UPQC for load balancing, power-factor correction and current harmonic mitigation

So as to demonstrate the reaction of UPQC for burden adjusting, control factor redress and current consonant alleviation, the heap under thought is a blend of a three-stage diode connect rectifier with resistive burden on dc side and lopsided R-L load in stage 'an' and 'b' as it were. It is seen that the supply flows are adjusted, sinusoidal and in-stage with the voltages as is appeared in Fig. 6 (b).

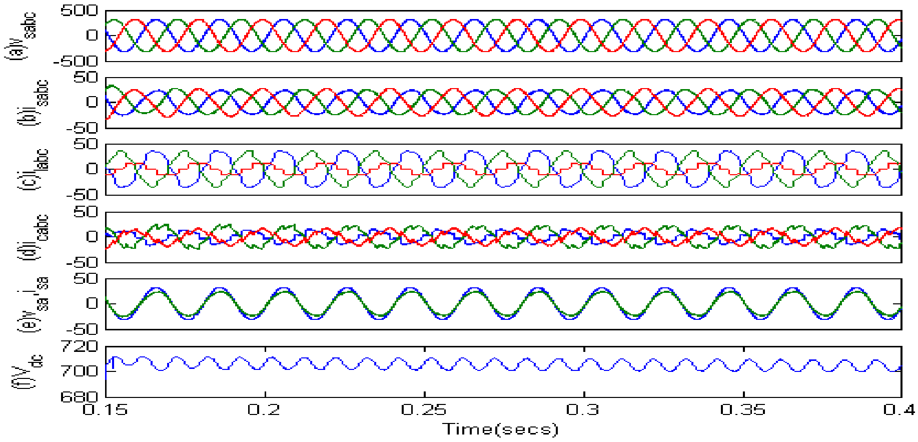

Fig. 6 Performance of UPQC for load balancing, power factor correction and current harmonic mitigation

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(iii). Performance of UPQC for load balancing, current harmonic mitigation and voltage regulation

Fig.7 demonstrates the reaction of UPQC for air conditioning voltage guideline at PCC, load adjusting and current symphonious relief with blended burden. The voltage guideline is accomplished utilizing shut APF; subsequently the arrangement APF is in off state. At t=0.15 sec the shunt APF is put into activity and at t=0.3 sec the resistive burden on the dc side of the corrects is multiplied abruptly, as appeared in Fig. 7(c).The source flows are sinusoidal and offset with expanded adequacy, as appeared in Fig.7(b). The UPQC framework manages Vtmn (the pinnacle abundancy) at its reference an incentive as appeared in Fig. 7 (f) even with expanded burden. The supply flows are sinusoidal and marginally driving regarding supply voltages, which are important to make up for the line impedance drop as appeared in Fig. 7(e). The dc transport voltage of UPQC is additionally directed at its reference worth and subsequently a self-supporting dc transport is acquired as appeared in Fig. 7(g).

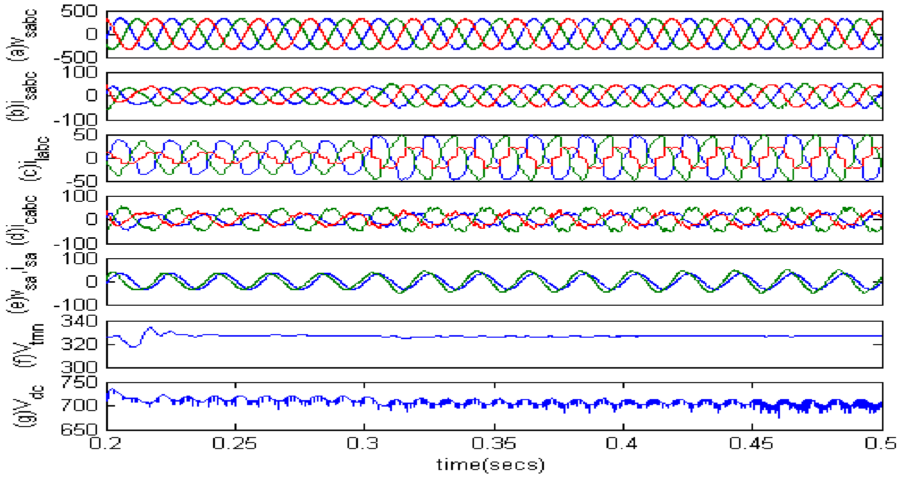

Fig. 7 Performance of UPQC for load balancing, current harmonic mitigation and voltage regulation

(iv). Performance of UPQC for load balancing, power-factor correction, current and voltage harmonic mitigation

Fig.8 demonstrates the reaction of UPQC for burden adjusting, control factor redress, voltage consonant alleviation and current symphonious relief. So as to confirm the viability of control calculation for voltage consonant relief, a three-stage diode connect rectifier with resistive burden on dc side is exchanged on at 0.05 sec. In view of this the voltage over the heap winds up mutilated. To imagine the shunt APF and arrangement APF execution independently, both APF's are put into activity at various moment of time. At time t=0.1 sec, shunt APF was put into task first. It is seen that the supply flows are adjusted; sinusoidal and in-stage with the voltages even under non-sinusoidal utility voltage.

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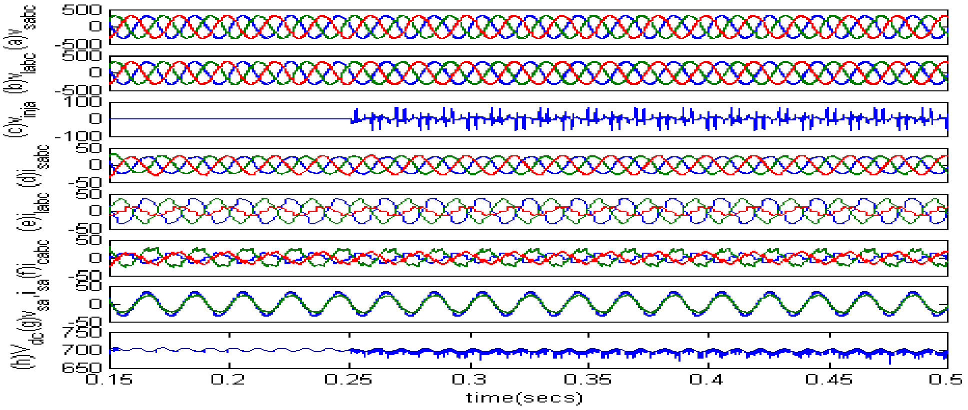

Fig. 8 Performance of UPQC for load balancing, power factor correction, current and voltage harmonic mitigation

VI. CONCLUSION

The presentation of UPQC has been explored under different reasonable circumstances. A configuration of UPQC using UTT based control has demonstrated satisfactory working. The execution of the UPQC has been assessed as far as different power quality upgrades like load balancing, power factor correction, voltage and current harmonics mitigation, voltage regulation at PCC, mitigation of voltage sag, swell and voltage dip. In expansion to this the exhibition of UPQC was discovered acceptable during transient conditions. The after effect of this investigation might be helpful for potential uses of UPQC under wide practical situations. The presentation of UPQC can be additionally improved by appropriate tuning of PI controllers.

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