RESEARCH ARTICLE OPEN ACCESS

A NEW CONTROL STRATEGY FOR UNIFIED POWER QUALITY CONDITIONER TO IMPROVE STABILITY IN A GRID

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Abstract:

In now a days the power system playing a major role in all sectors, because the power supply is necessary for maximum applications. The power quality issues are major problem. To overcome this problem, several custom power devices are being used all over the world. Out of these custom power devices Unified Power Quality Conditioner (UPQC) is found capable for load balancing. In this paper, we propose an idea to upgrade the UPQC (Unified power Quality conditioner) for enhancing power quality utilizing with renewable source. The power quality issues happened as a non-standard current, harmonics, frequency and voltage and makes failure of sensitive loads and interruptions. The UPQC has the capacity of enhancing power quality at the distribution sides. As it were, the capacity of UPQC is to wipe out the disturbances that influence the execution of the basic load in a power system. For a nation like India, Power Quality is a major issue as the repeated variations in power supply. Subsequently, it is compulsory to make key strides towards the improvement. This exploration portrays the UPQC standards and power reconstruction (voltage and current) for balanced / unbalanced voltage sags/swells during a distribution system. This paper proposes the arrangements of UPQC with different controllers. The operation of the proposed system is simulated with MATLAB7.01.

Keywords — **Non-linear load, Active power filter, distributed generator, power quality, unified power quality conditioner(UPQC), power factor, sag and swell**.

I. INTRODUCTION

It has been dependably a test to keep up the quality of electric within the acceptable limits. The bad effects of the poor power quality will be discussed. The power losses are increased by the poor power quality, nonstandard behavior of equipments causes this problem. The far reaching utilization of energy electronic based systems has additionally put the weight on control system by producing harmonics in voltages and currents. The term active power filter (APF) is a broadly utilized wording in the region of electric power quality improvement. APFs are used to mitigate some major power quality problems effectively. This paper focuses on unified power quality condition (UPQC).The UPQC is one of the APF relatives where shunt and series arrangement APF functionalities are coordinated together to accomplish better control more than a few power quality issues at the same time.

II. UPQC

In UPQC TWO types of APF exist, there are shunt APF and series APF. The shunt

APF is the most encouraging to handle the current-related issues, though, the series APF is the most appropriate to conquer the voltage-related issues. Since the advanced distribution system the demands of a better quality of voltage and current is high, so that the APFs has incredible scope in actual practical implementation. In any case, introducing two separate devices to compensate voltage-and current-related power quality issues, independently, may not be a cost effective solution. From the system configuration the shunt and series filters are connected back to the dc link.

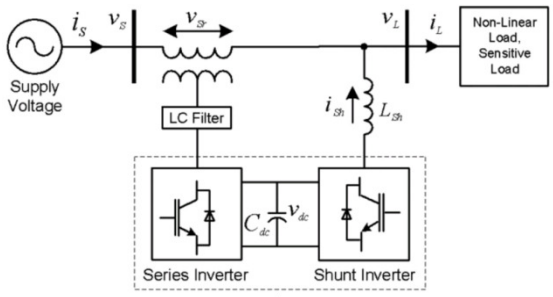

Fig.1.Block diagram of UPQC

The topology was tended to as line voltage controller/conditioner. The back-to-back inverter system design genuinely came into consideration when demonstrated the practical application of this topology with 20 kVA experimental results. They named this device as unified power quality conditioner (UPQC), and since then the name UPQC has been popularly utilized by majority of the researchers. In development of power system, an UPQC is like a unified power flow controller (UPFC). Both UPQC and UPFC take up two voltage source inverters (VSIs) that are associated with a typical dc energy storage element. The UPFC engaged in power transmission system whereas UPQC is engaged in a power distribution system. However, a UPFC only needs to provide balance shunt or series compensation, since a power transmission system by and large works under an adjusted and contortion free environment. Then again, a power distribution system may contain dc components, distortion, and unbalance both in voltages and currents. Along these lines, an UPQC work under this condition while performing shunt as well as series pay. The fundametal reason for an UPQC is to make up for supply voltage control quality issues, for example, sags, swells, unbalance, flicker, harmonics, and for load current power quality problems, such as, harmonics, unbalance, reactive current, and neutral current.

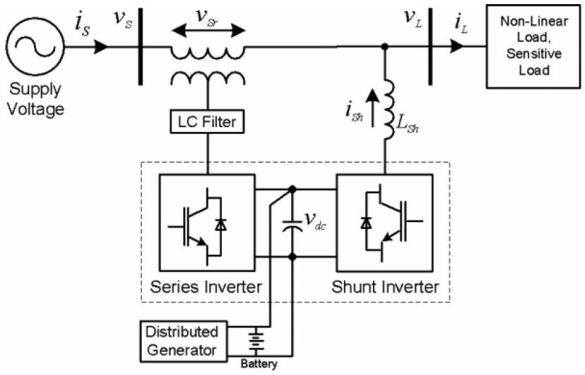

Fig.2.Block diagram distributed generated system

The fig.2 represents the distributed generated system which is connected to the UPQC system. Both figures demonstrates a single line representation of the UPQC system configuration. The main parts of the system is following.

1) Two inverters—one associated over across the load which goes about as a shunt APF and other associated in series with the line as that of series APF.

2) The Shunt inverters are coupled with system by using shunt coupling inverter. It additionally helps in smoothing the present wave shape. The isolation transformer is sometimes used to isolate the inverter from the network electrically.

3) The two inverters are interconnected by using dc link. This link also used to maintain a constsnt self-supporting dc bus voltage across it. The dc link is formed by using capacitor or inductor.

4) The LC filter acts as a low pass filter by eliminate the switching repples from the generated inverter output voltage.

5) Series inverter in the network is connected with help of series injection transformer. A suitable turn ratio is considered to reduce the current or voltage rating of the series inverter.

6) The distributed generator consist of renewable enegy source, which is used to enhance the electric power drop in the line.

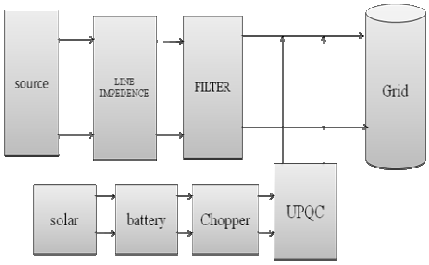

Fig .3 Block diagram of upqc system

This fig.3 presents a block diagram of upqc system, combination of the unified power quality conditioner (UPQC) with filter terminals. The unbalanced components like voltage and current can also be found by subtracting the positive sequence component from the distorted voltage. The two filters shunt and series component are used to determined, the unbalance voltage and current in the power system.

III. UPQC CLASSIFICATION

The UPQC brodly classified in many categories.

In supply system upqc employed both single phase and three phase system. It has different configeration. There are,

1. Single phase
   - Two H-bridge
   - 3-leg topology
   - Half bridge

2. Three phase
   - Three wire
   - Four wire

     Four –leg

     Split capacitor

     Three-H bridge

For voltage sag compensation there are four types of upqc.

1. UPQC-P
   (Active power)
2. UPQC-Q
   (Passive power)
3. UPQC-VAmin
   (Minimum VA loading)
4. UPQC-S
   (Active-Reactive power)

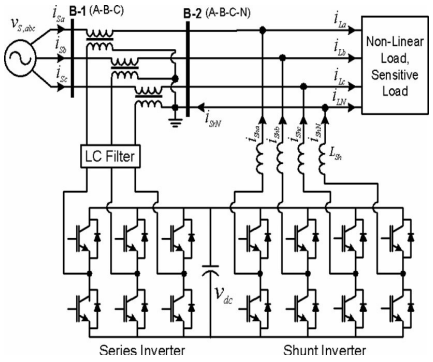

Fig.4 UPQC-S configuration

The above diiagram represents the configuration of upqc for three-phase three-wire system. It clearly represents the series and shunt inverter which is commonly connected with the dc link. And the filers are connected in the circuit.

IV. BLOCK MODEL

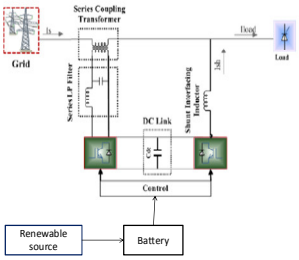

Fig.5 block model of upqc with renewable source

The block model clearly represents the enhancing of electric power with upqc by using renewable enegy source. The demand electric power will taken in the renewable source which is stored n the battery. After that the power will send into the dc link through series and shunt copensation. From this upqc we enhance both current and voltage, so it very effective method.

V. FUZZY CONTROLLER (WORK 1)

Fuzzy logic controller eliminates the draw backs of PI controller. The difficulty with PI controller is that it is a feedback system, with constant parameters, and no direct knowledge of the process. Fuzzy logic is close in spirit to human thinking and natural language. It provides an effective means of capturing the approximate and in exact nature of systems. The fuzzy control is basically a nonlinear and adaptive in nature, giving the robust performance in the cases where in the effects of parameter variation of controller is present. By using this controller we attain a maximum power factor but little bit voltage sag and swell are present.

VI.SIMULATION DIAGRAMS FOR UPQC WITH FUZZY CONTROLLER.

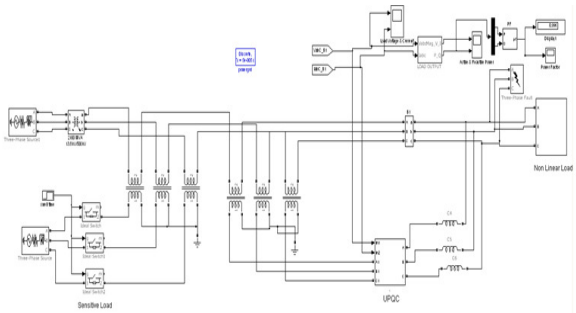

Fig. 6 circuit diagram for upqc with fuzzy controller

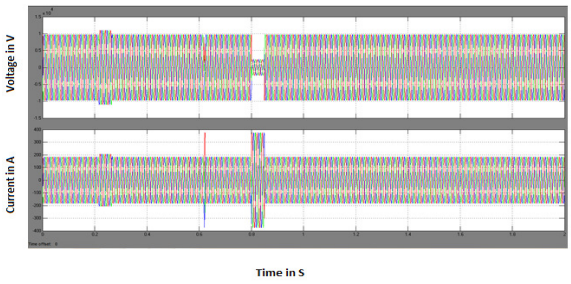

Fig. 7 voltage & current for upqc with fuzzy controller

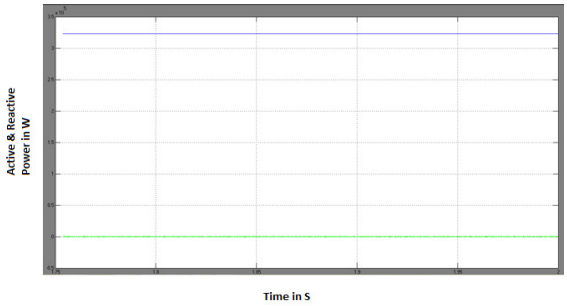

Fig.8 power for upqc with fuzzy controller

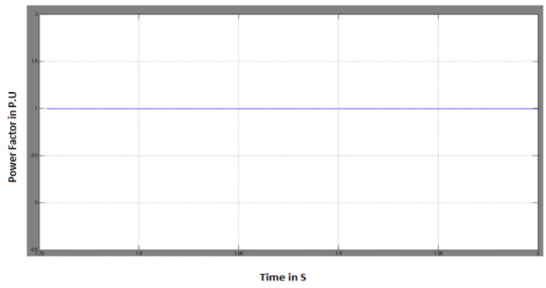

Fig.9 powerfactor for upqc with fuzzy controller

The above simulation diagrams represents the performance of the upqc system with fuzzy controller. The output waveforms gives the clear analysis of the voltage sag and swell and power factor.

VII. ADAPTIVE POWER BALANCE CONTROL (WORK 2)

This adaptive controller eliminates the drawbacks of fuzzy controller. For that reason, one of the accurate search techniques called ADPBC has been apply to resolve the power quality issues. This control method is used by one of the adaptive control, which adapt the controlled system with parameters. Compare to other controllers it is very effective. Because other controllers needed a control law to adapt the changing conditions, but this controller is different from other controller, it does not need any priori information, it adapts itself to such changing conditions. A simple program is enough to control the circuit.

VIII. ECONOMICAL AND TECHNICAL CONSIDERATION

In technical point of view, the active power filters can found early in 1970s. Enhancing the electric power using UPQC is reported since 1990s. Various power quality devices available in market and upqc also available in market now a days. At the time the some voltage sag and swell are remain constant, to reduce that we proposed this paper. By using adaptive controller and renewable source we try enhance the power quality higher than the existing system.

IX. CONCLUSION

In recent years the usage of the electric power is increased enormously, so the power quality problems are also increased. The nonlinear load, power quality prablems are major problem. The nonlinearity causes difficulties in solving this problem using classical methods. An advanced design of UPQC for a 3 phase 3 wire distribution systems is proposed in this paper. By analyzing the power system the voltage sag and swell, interruption, distortion and harmonics are major problems to reduce the quality of the power. The proposed system has the capability to mitigate voltage and current related power quality issues with reduced dc link voltage rating. The fuzzy and adaptive controllers are eliminates the drawbacks of the existing controllers.

REFERENCE:

[1] Enhancing Electric Power Quality Using UPQC: A Comprehensive Overview by Mr. Vinod Khadkikar.

[2] A Proportional-Resonant Current Controller for Selective Harmonic Compensation in a Hybrid Active Power Filter by Leopold Herman, Igor Papic and Bostjan Blazic.

[3] Enhanced Upqc For A Single Phase Supply System To Improve Power Quality Using Super Capacitor Energy Storage System by V. Prakash, T Rama Subba Reddy, S. Tara Kalyani

[4]An Adaptive Controller for Power System Stability Improvement and Power Flow Control by Means of a Thyristor Switched Series Capacitor (TSSC) by Nicklas Johansson, Lennart Ängquist and Hans-Peter Nee.

[5] A Shunt Active Power Filter With Enhanced Performance Using ANN-Based Predictive and Adaptive Controllers by Avik Bhattacharya and Chandan Chakraborty.

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M.R.MOHANRAJ was completed his under graduation (B.E.,EEE) in the year of 2007 at Valliammai Engineering College, Chennai and post graduated M.E (Power Electronics and Drives) at Government collegeof Engineering, Salem in the year of 2010. His teaching experience is more than 7.6 years and also published more than 4 reputed journals. He is currently working as Assistant Professor in the department of EEE at Excel College Technology, Komarapalayam, from may 2012 He has life membership in ISTE, IAENG.His research interest involves Power Quality and UPQC.

R.GUNASEKARAN was completed his under graduation (B.E.,-EEE) in the year of 2003 at Kongu Engineering College, Perundurai and post graduated M.E (Power Electronics & Drives) at KSR College of Technology, Tiruchengode in the year of 2010. He is doing Ph.D.,(part-time) in Anna university, Chennai at 2015 onwards. He is currently working as Assistant professor in the department of EEE at Excel College of Engineering and Technology, komarapalayam since June 2015. His teaching experience is more than 11 years and also published more than 10 reputed journals. He has life membership of ISTE,IAENG. His research interest involves in Power Electronics, Renewable Energy.