Mitigation of Voltage Sag/Swell Using UPQC under Balanced and Distorted Load Conditions

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Abstract: *This Paper deals with unified power quality conditioners ,which aim at the integration of series-shunt active power filter .The main purpose of a UPQC is to compensate for voltag sag/swells, negative sequence current ,harmonics. In the other words, the UPQC has the capability of improving power quality at the point of installation on power distribution systems.*

Key words : *voltage, UPQC, SRF,*

1. INTRODUCTION:

In present era, with increased use of power electronics controller and high efficiency sensitive variable speed drives, both electrical utilities and end user suffer the problem of power quality.The power electronics controllers are less tolerant to problem like voltage sag, swell, harmonics etc. and it affect voltage, current, or frequency deviation that results in failure of customer equipment due to this industry suffer quality, financial loss and damage of high quality equipment.UPQCisolates the utility from current quality problems of load and in the same time, isolates the load from voltage quality problems of utility.Voltage sags and momentary power interruptions are probably the most important Power Quality problem affecting industrial and large commercial customers. These events are usually associated with a fault at some location in the supplying power system.A voltage sag is a short duration reduction in RMS voltage which can be cause by a short circuit,overload or starting of electrical motor.A voltage sag happens when the RMS voltage decrease between 10% - 90% of nominal voltage for one half cycle to one minute.A voltage swell happens when the RMS voltage Increase between 110% -180% of nominal voltage for one half cycle to one minute.

2. UNIFIED POWER QUALITY CONDITIONER:

UPQC for harmonic elimination and simultaneous compensationof voltage and current, which improve the Power Quality, offered for other harmonic sensitive loads at the point of common coupling. In almost all of the papers on UPQC, it is shown that the UPQC can be utilized to solve PQ problems simultaneously. Fig. 1 shows a basic system configuration of a general UPQC with series and shunt APFs. The main aim of the series APF is to obtain harmonic isolation between the load and supply. It has the capability of voltage imbalance compensation as well as voltage regulation and harmonic compensation at the utility-consumer PCC. The shunt APF is used to absorb current harmonics, to compensate for reactive power, and to regulate the dc-link voltage between both APFs.

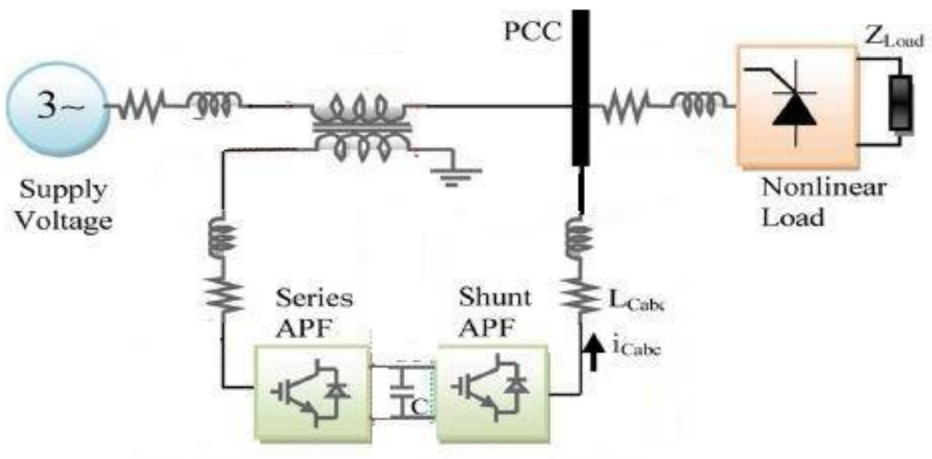

Figure 1. Basic UPQC

3. SYNCHRONOUS REFERENCE FRAME:

The SRF method can be used to extract the harmonics contained in the supply voltages or currents. For current harmonic compensation, the distorted currents are first transferred into two-phase stationary coordinates using $\alpha-\beta$transformation. After that, the stationaryframe quantities are transferred into synchronous rotating frames using cosine and sinus functions from the phase-locked loop . The sinus and cosine functions help to maintain the synchronization with supply voltage and current. Similar to the $p-q$ theory, using filters, the harmonics and fundamental components are separated easily and transferred back to the $a-b-c$ frame as reference signals for the filter. The conventional SRF algorithm is also known as $d-q$ method, and it is based on $a-b-c$ to $d-q-0$ transformation (park transformation).

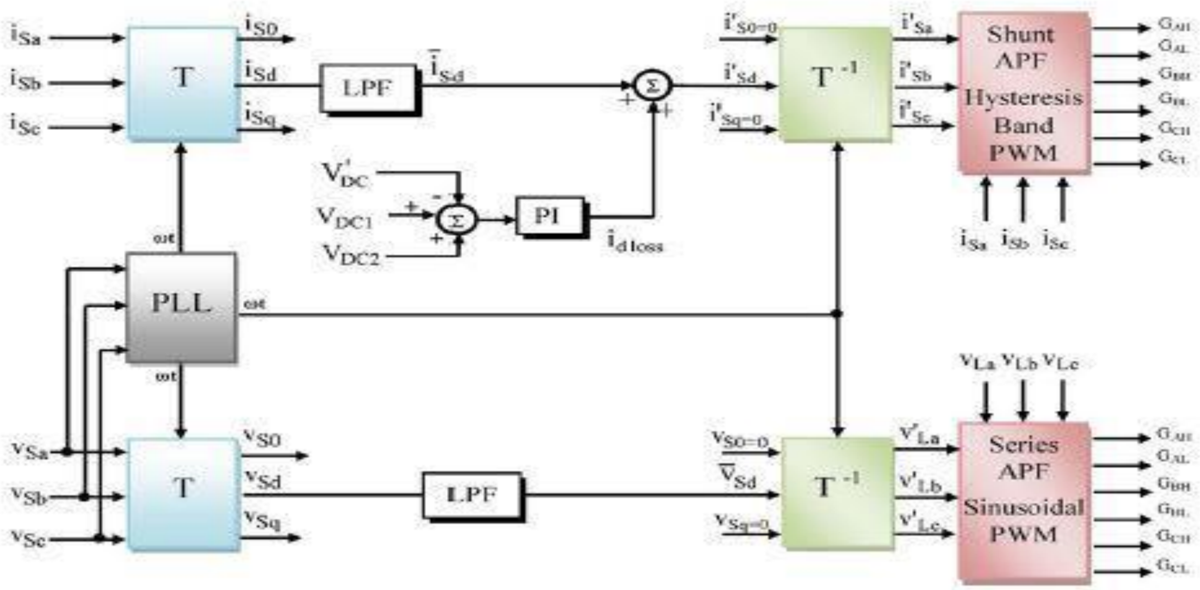

Figure 1.1.. SRF BASED UPQC CONTROL

SIMULATION MODEL WITHOUT UPQC:

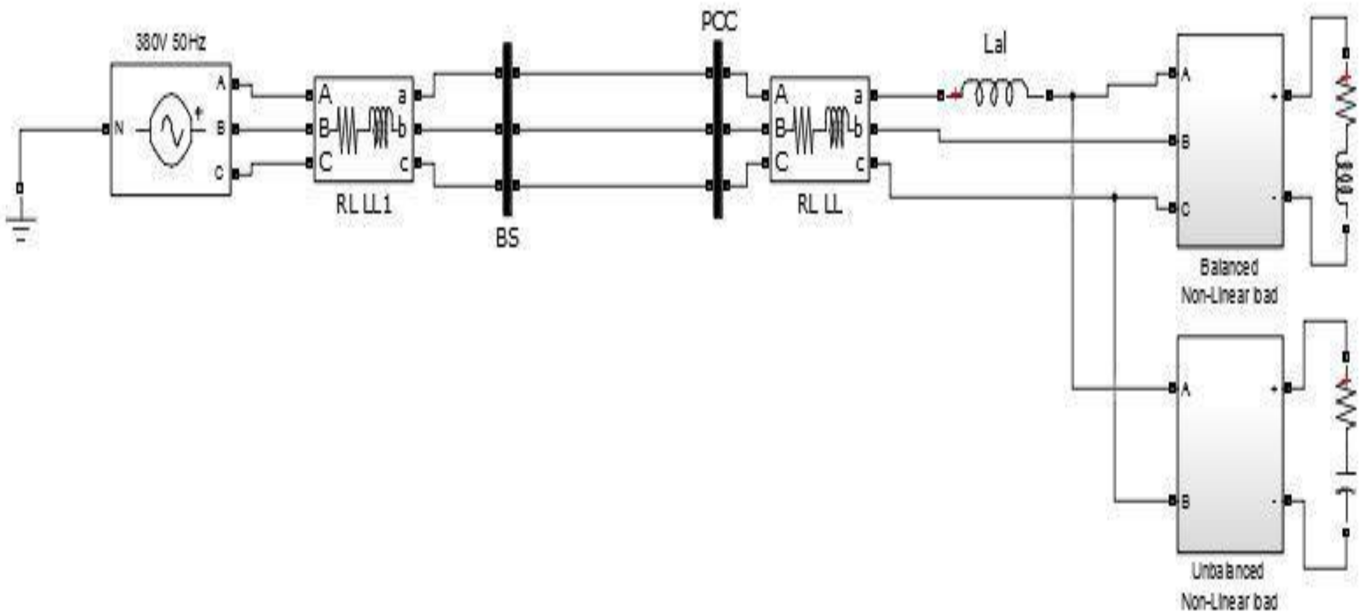

Figure 1.2. Without UPQC

4. SIMULATION RESULTS:

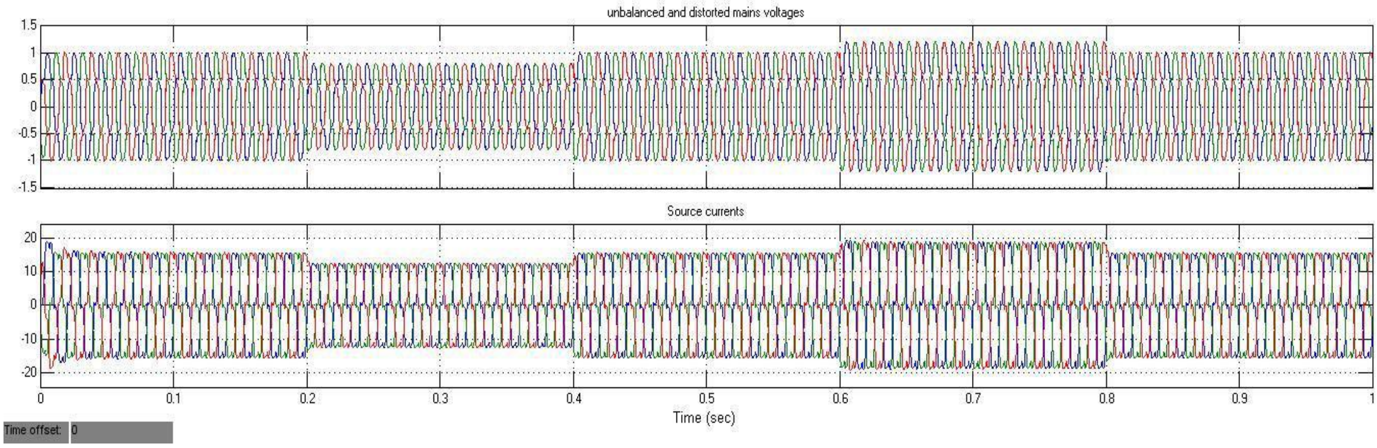

Figure 2. SOURCE VOLTAGE

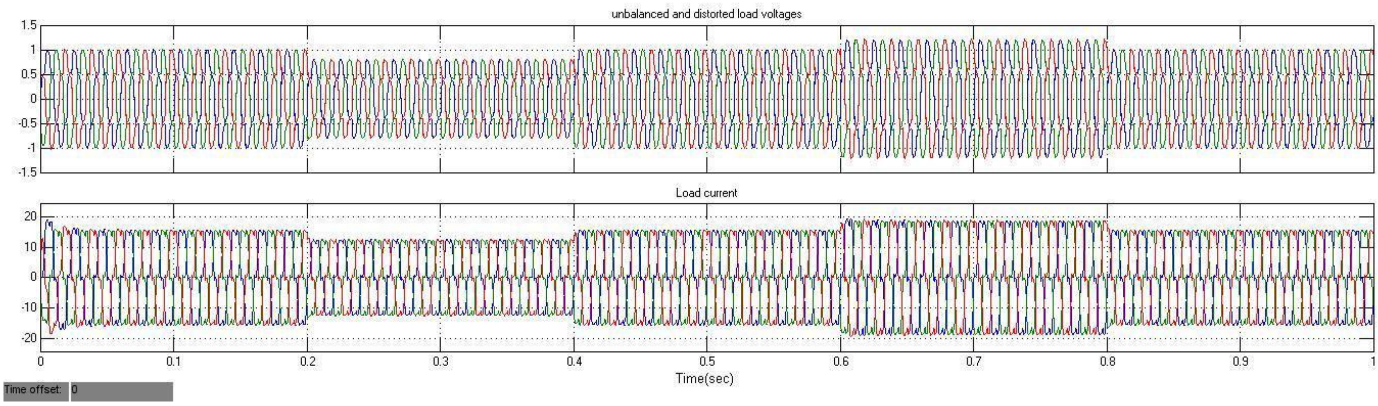

Figure 3. LOAD VOLTAGE

SIMULATION MODEL WITH UPQC :

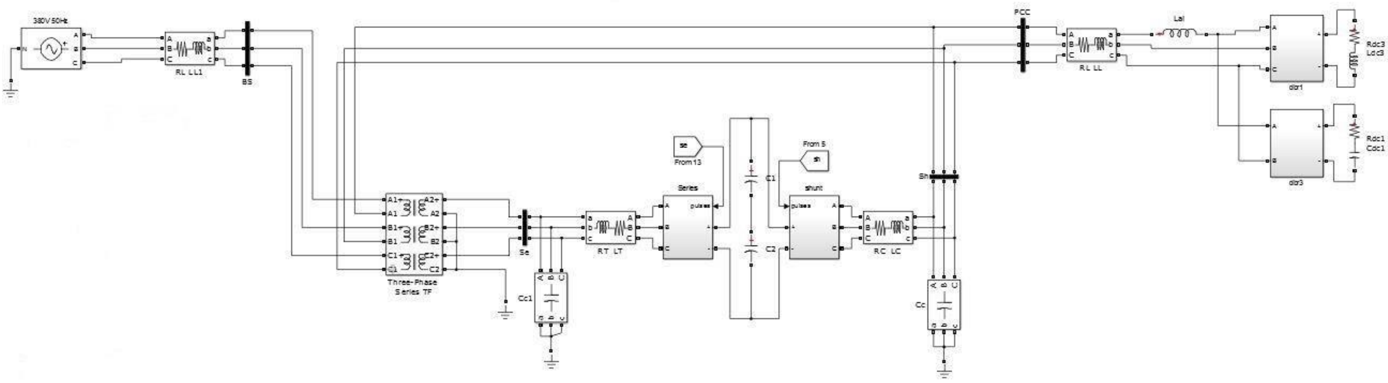

Figure 4. With UPQC

SIMULATION RESULT:

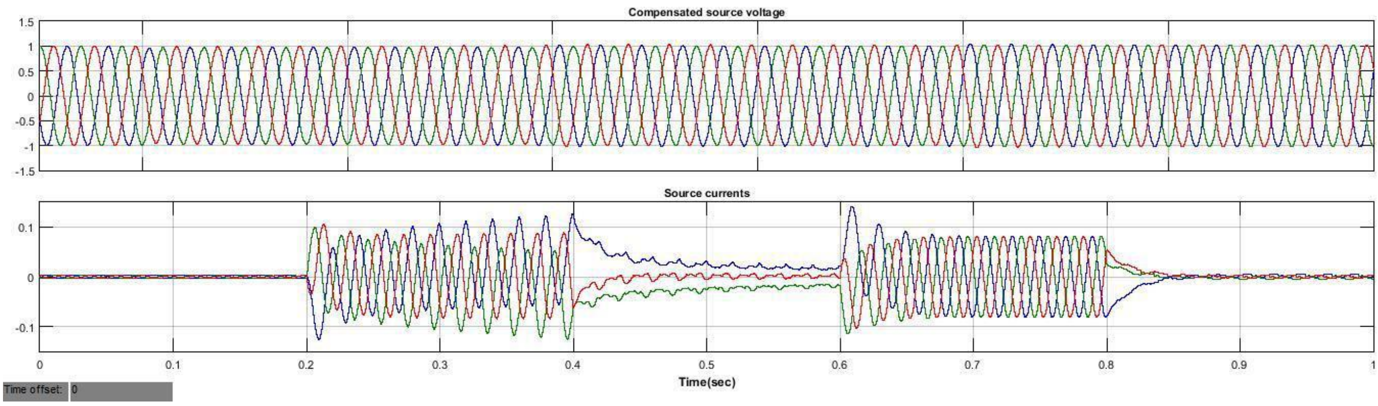

Fig 5. Source voltage

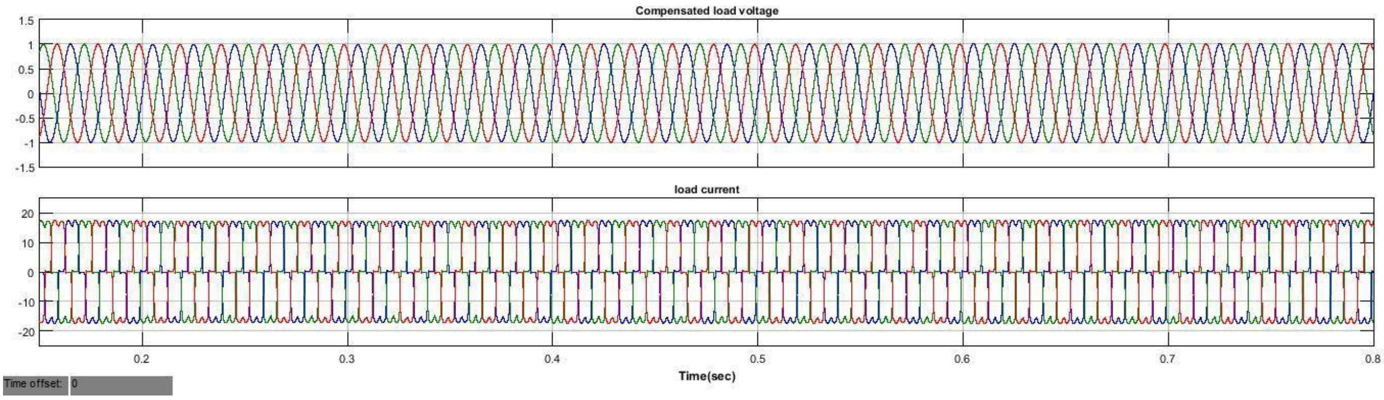

Fig 6.Load voltage

4. CONCLUSION:

The main objective of this paper was to develop the UPQC scheme and its two controllers for the improvement of power quality in power distribution system, by eliminating the voltage sag and swell. The simulation has been implemented using the SRF control strategy controllers.

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