# Power Quality Improvement In Distribution System With DVR

**M. Karuppiah, R.Nishanth, V. Saravanan, A. Dinesh Kumar**

**Abstract:** In this project, we can improve the power quality in the electrical system. If the Power quality may vary according to their load. If the power quality varies it may leads to cause the sags, swells, voltage unbalance and harmonics. By using the dynamic voltage restorer (DVR) to increase the power quality. Here well implemented the dual PQ theory and instantaneous space phasor (ISP) act as a control algorithm. Using the above concept we can improve the power quality in both generation and distribution side.

**Index Terms:** dynamic voltage restorer, instantaneous space phasor, power quality.

## 1. INTRODUCTION

New trends in power quality a number of the problems that have revived and triggered the interest in power quality will be declared as: Higher demand on supreme power quality. IT-technology, machine-controlled production plants and business activities need an honest and reliable power offer. De-regulating and commercializing of the of electric energy markets has made power quality a parameter of interest to achieve a higher price per kilowatt, to increase the profit and share of the market. Decentralization of the assembly of electricity with integration of different energy sources and tiny generation plants has enhanced bound power quality issues like surplus of power, voltage variations and glints. The enhancements within the power natural philosophy space and processing capability have created improvement in power quality potential by means that of relative efficient power electronic controllers. Here trends have triggered interest in different types of power electronic controllers to mitigate power quality problems [1-4]. Now a day's most of the equipment like domestic, industrial and electrical components are very sensitive to power quality disturbance and variations. if the power quality will vary, it may cause the sags, swells, harmonics, unbalance voltage and flickers. By using this paper we can reduce the power quality issues. Here we using the DVR are used to remove the voltages sags and swells in electrical system for the improvement of power quality issues. It also used to decrease the effect of harmonics and swells. Here we implement concept of dual PQ theory and instantaneous space phasor (ISP) is the general control algorithm to control the dynamic voltage restorer for power quality improvement using the above the concept we can solve the power quality issues for existing system [5, 6].

## 2. DYNAMIC VOLTAGE RESTORER

The dynamic voltage preserver could be a series connected device, which by voltage injection wills management the load voltage. In the case of a voltage dip the DVR injects the missing. The DVR can by series voltage injection compensate for a voltage dip at the supply side and restore the load voltage for a sensitive load Voltage quality The voltage quality has an impact on the control and design of a DVR and the DVR performance depends on the voltage quality at the location the DVR is inserted [7, 8]. In this section voltage harmonics, non-symmetry and voltage dips are treated to give a basic introduction to key voltage parameters for a DVR. Voltage harmonics Non basic voltage harmonics typically seem the least bit levels within the electrical system. In relation with the DVR the harmonic content of the voltage before and when the DVR has major interest. Before the DVR, during no-load conditions the so called background distortion level can be measured and the level of distortion may influence the control of the DVR. The DVR can inject some harmonics and a vector addition with the background harmonics gives the resulting load voltage harmonics. The load voltage harmonics and also the ensuing load voltage distortion is a very important analysis parameter of the DVR performance. Sources to the distortion of the load voltages vary and the three main sources are: Background voltage harmonics; Background harmonics can easily be transferred to the load voltage side. During voltage injection harmonics from background distortion can be amplified or damped in the DVR control system. A supply voltage with a high harmonic content can complicate the synchronization to the supply and interfere with the DVR control. Harmonics injected by the DVR; The THD of the injected series voltage depends on the DVR hardware [8-12]. E.g. converter topology, switching frequency, 10 Power quality and controllers for voltage dip mitigation modulation method, modulation index and filtering. Non-linear effects in the converter can even be a pure fundamental reference voltage inject harmonics, caused by non-linear effects in the DVR such as dead-time, transistor and diode voltage drop. Non-linear load currents; A non-linear load current distorts the load voltage, which depends on the strength of the grid, the inserted DVR and the resulting impedance seen by load. This will include impedance in the DVR and the grid.


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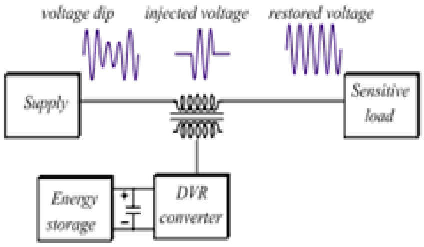


***Fig.1*** *Dynamic voltage restorer*

## 3. DUAL PQ THEORY

One vital application of the p-q Theory is that the compensation of undesirable current parts. Figure illustrates the basic idea of shunt current compensation for a three-phase three-wire system. It shows a source (power generating system) supplying a non-linear load that is being compensated by a shunt compensator. For the sake of simplicity, here it is assumed that the shunt compensator is a three-phase controlled current source that can draw or inject any set of arbitrarily chosen current references * iCa , * iCb and * iCc , which are in fact the undesirable current components consumed by the load. A general management technique for shunt current compensation, to be used in the controller of the shunt compensator, is shown in Figure. The calculated fast real power, p, of the load can be separated in its average ( p) and oscillating (p ~) components. Likewise, the load fast imagined power, q, can be separated in its average (q) and oscillating (q ~) components. Then, undesired real and imaginary power-components of the load can be compensated by using adequately designed filters in the block "Selection of the power to be compensated". The powers to be compensated are represented by * − pc and * −qc . Note that, the adopted current convention in Figure is such that the source current is the sum of the load current and the compensator current. From * − laptop and * −qc it's potential to calculate i α * and iβ * . Then, the inverse transformation from α-β to a-b-c is applied to calculate the instantaneous values of the three-phase compensating current references * iCa , * iCb and * iCc . ideal (without commutation inductances) three-phase thyristor rectifier, with a constant (no ripple) current source at the dc side. Note that in this type of load there is no current at the neutral wire. Each figure shows the a-phase current component that should be eliminated from the load current and the a-phase compensated source current, together with the a-phase voltage. Furthermore it's conjointly shown the fast real power at supply (pS) and also the fast imagined power at supply (qS). Note that the compensator must produce the inverse of the currentcomponent consumed by the load that must be eliminated. The ideal compensated current can be calculated simply by subtracting the current to be eliminated from the load current. The powers PS and qS correspond to the new fast powers delivered from the supply when compensation. In all these cases it is considered that no unbalances or distortions are present in the system voltages.

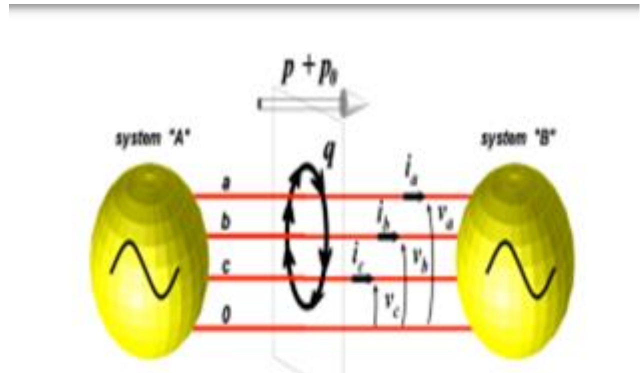


***Fig 2.*** *Instantaneous total energy flow per time unit*

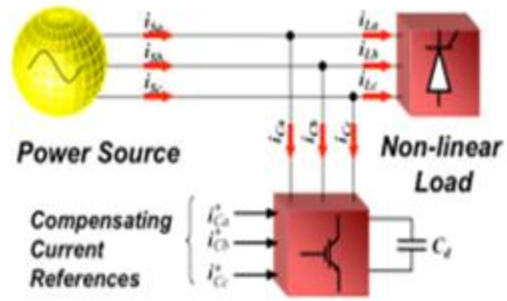


***Fig.3*** *Basic principle of compensator*

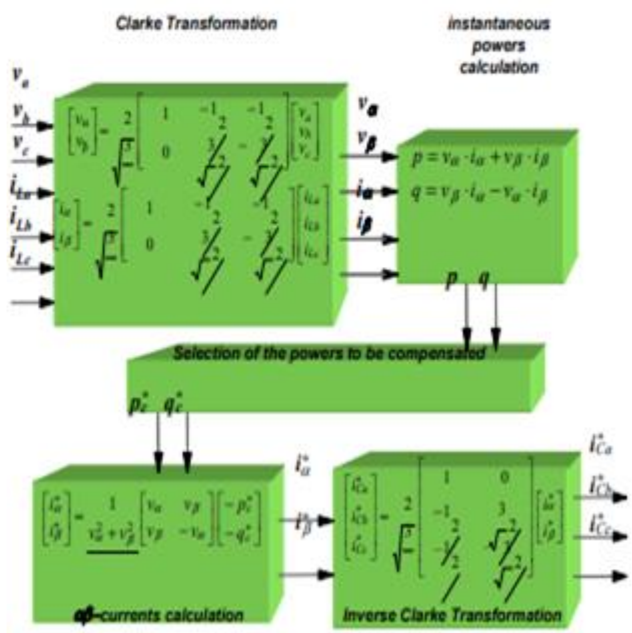


***Fig.*** *4. PQ Theory Defining diagram*

## 4. EXISTING SYSTEM

The DVR is connected in series with the grid terminal before the critical loads and injects the required amount of compensating voltage to maintain the load voltage within the specified value. A DVR generally consists of DC energy storage device, voltage source inverter (VSI), passive filter components and injection transformer. Several control techniques focusing on energy optimized control algorithm or optimum rating DVR topology have been presented. One of the system is A theoretical investigation of the energy optimized control strategy for medium voltage DVR is presented. The drawback related to above concept is that voltage compensation in cases of nonlinear loads, distorted grid voltages and switched load conditions which are very common in power distribution system, are not fully addressed. One of the other a strategy proposed is Self-supported DVR for unbalance and non-linear loads are presented, but this involves additional investment on passive shunt filters. Considering the reliability aspect during under voltage or high depth voltage sag, DVR with battery energy support is presented, In order to improve the transient response, DVR based on hybrid energy storage system comprised of battery, Super capacitor or superconducting magnetic energy storage are proposed. a robust DVR control scheme is required for smooth energy transfer. Several new DVR topologies using switching cell multilevel converter, cascaded open end winding transformer are presented in the literature. An enhanced voltage sag compensation scheme is proposed, An interesting pre sag load voltage compensation scheme based on elliptical trajectory estimation and two degrees of freedom resonant DVR control schemes are presented.

## 5. PROPOSED SYSTEM

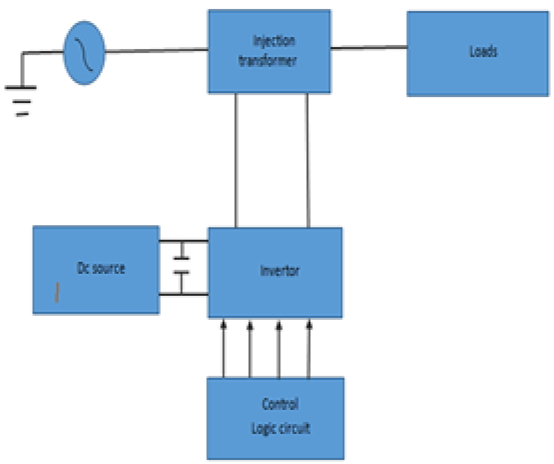


***Fig. 5****. Proposed system block diagram*

In this project, dual PQ theory and instantaneous space phasor is to control the Dynamic voltage restorer for power quality improvement. The proposed algorithm is generalized enough to compensate instantaneous as well as long term voltage disturbances to protect the critical loads while optimizing the active power requirement for power quality improvement. DC source is connected with the inverter .it converts the DC source into AC source. Here the control circuit act as a dual PQ theory is compare the current and voltage in both side of the generating and distribution system and provides the reference voltage in transmission line for power quality improvement.

## 6. ADVANTAGES

- Steady-state voltage compensation
- Dynamic sag compensation
- Dynamic swell compensation
- Unbalanced and distorted grid voltage compensation

## 7. APPLICATIONS

- Improve the power quality in load end
- Voltage balancing.

## 8. SIMULATION DIAGRAM

Fig. 6*. Simulation diagram*

***Fig.7****. The output waveform for fault occurs in line*

***Fig:.8****.The output waveform for after rectifying the faults*

## 9. CONCLUSION

A straightforward DVR control calculation dependent on ISP and double PQ hypothesis has been created to produce the prompt reference voltage of the DVR to remunerate load voltage. Contingent on the lattice terminal voltage and burden flows, the DVR remunerates the heap voltages with the improved dynamic power course through DVR. This outcome in a decrease of DC vitality stockpiling prerequisite. This system is summed up enough to remunerate momentary voltage unsettling influences as well as help the heap amid long haul voltage aggravations, if there is an adequate dynamic power support from the dc connect. The point by point reenactment and exploratory examinations show that the proposed DVR control calculation can remunerate the heap voltage successfully with the nearness of nonlinear burden and twisted matrix voltages.

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