

# POWER QUALITY IMPROVEMENT USING DYNAMIC VOLTAGE RESTORER (DVR)

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**Abstract** - Power electronics device are used to make the life more easier using technology. Dynamic Voltage Restorer is most economical and efficient Custom power device for mitigation voltage sag/swell. The important parts of the DVR comprise of voltage source inverter (VSI), injected transformers, filter and a dc energy source. The principle of the DVR is utilized to inject the voltage in series and in synchronism with the standard voltages with a goal to compensate voltage influences. There are various control techniques used for the operation of Dynamic Voltage Restorer. This report presents the Discrete PWM technique Using PI controller, Hysteresis voltage controller, Hysteresis current controller, Fourier transform for sensing the voltage sag and generation of switching pulses of inverter of dynamic voltage restorer. The control technique based on voltage reference signals, and the proposed system is designed in MATLAB software, results shows that the how dynamic voltage restorer is useful for voltage sag/swell improvement in distribution system.

**Key Words:** Static Series Compensator(SSC),Dynamic Voltage Restorer(DVR).

## 1. INTRODUCTION

Recent technological advancement lead to a rapid growth in number of nonlinear load present in the power distribution system which adversely affect the quality of power supply. This nonlinear load distort the supply voltage waveform. This result in power quality disturbances[1]. Most industries are relay on the electronic drives and Programmable logic controller which are causes a problems like Voltage sag, voltage swell, harmonics, flicker, voltage transient etc. some definitions of power quality disturbances are as follow:

### 1.1 Voltage sags:

Voltage sag is a short duration reduction in rms voltage a short duration and half of a cycle. Which can be caused by a short circuit, overload or starting of electric motors.

### 1.2 Voltage swell:

Voltage swell is short duration reduction in rms voltage a short duration and half of a cycle. Which can be caused by switching off a large load, energization of a capacitor bank.

## 2. DYNAMIC VOLTAGE

From various power quality disturbances, voltage sags are the most common problem. It can be achieved by inject reactive power at point of common coupling. If a mechanical switched shunt capacitor connected at distribution transformer it can compensate the disturbances. It cannot compensate high speed transient. Some sag/swell are not compensate clearly. Other method is to use transformer taps, but this method is costly.so Custom power devices are used to overcome this problem. Most economical and efficient custom power device is Dynamic Voltage Restorer used in power system network. DVR is connected in series at point of common coupling. Custom power device that injects voltage into the system to regulate the load side voltage. DVR is installed in series between the supply and the critical load feeder at the point of common coupling (PCC).location of DVR shown in Figure 3.1. Other than voltage sags and swells compensation, DVR can also added other features like: line voltage harmonics compensation, reduction of transients in voltage and fault current limitations [2].

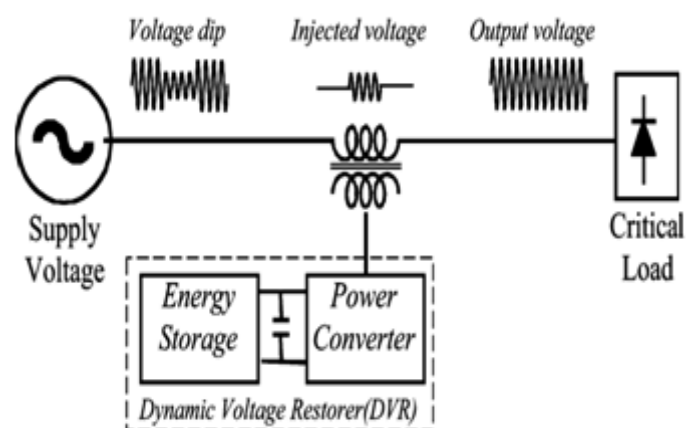


Fig.1: Location of DVR

### 2.1 Basic Configuration of DVR:

The general configuration of the DVR consists of:

- I. An Injection transformer
- II. A Voltage Source Converter (VSC)
- III. Storage Devices
- IV. A Control and Protection system

### 2.2 Protection mode:

DVR is protected from over current due to short circuit on load side or large inrush current. DVR isolated from the systems by using the bypass switches (S2 and S3 will open) and supplying another path for current (S1 will be closed).

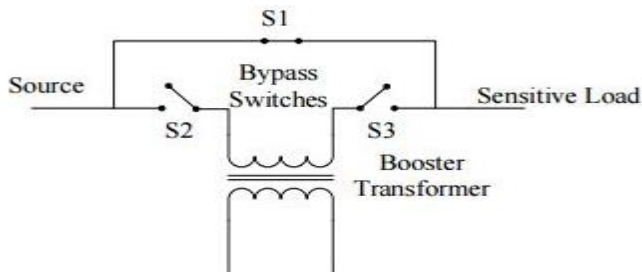


Fig.2: Protection Mode

### 2.3 Solutions for power quality problems :

Power Quality problems can be mitigate by installing a system at consumer side or utility side. Devices installed at consumer side is used when the equipment is less sensitive to power disturbances. And device installed at utility side can suppress or counteracts the disturbances. For power quality improvement major role played by utility side solution. Some of effective and economic measures are as follow:

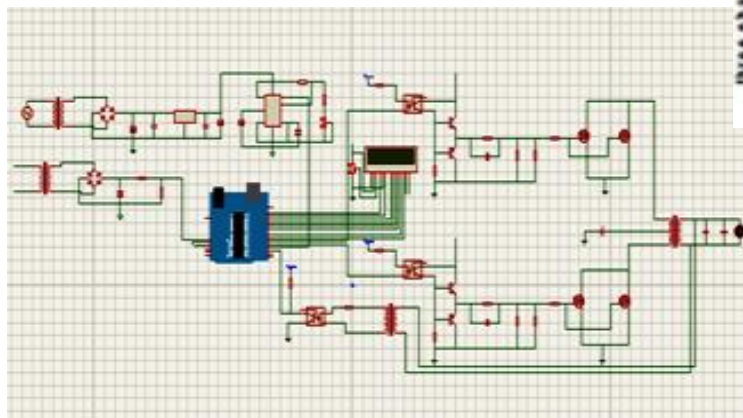


Fig.3: Circuit Diagram Constant DC-link voltage

A DVR with constant DC-link illustrated in Figure 3.5 Energy storage devices are needed. An additional converter is expected to convert energy from the main storage to a small DC-link and control and stabilize the DC-link voltage. It offers a constant DC-link voltage at all times and does not increase the current drawn from the supply. Power taken from the grid is reduced according to the Sag .

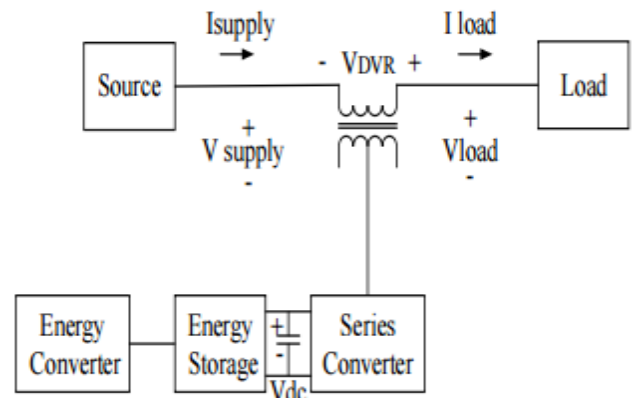


Fig.4: DVR topology with constant DC-link voltage

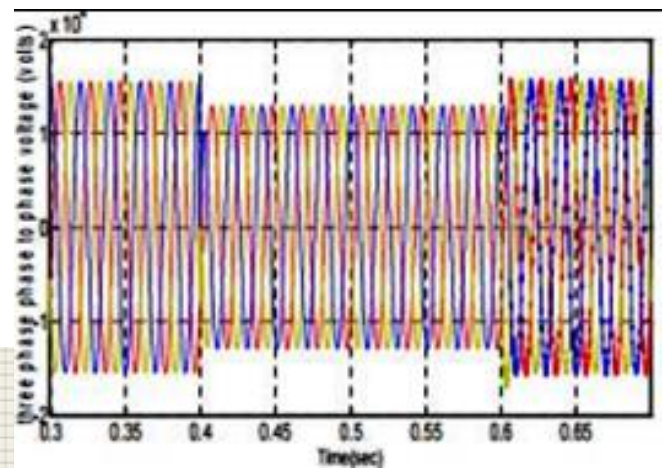


Fig.5: Output Waveform

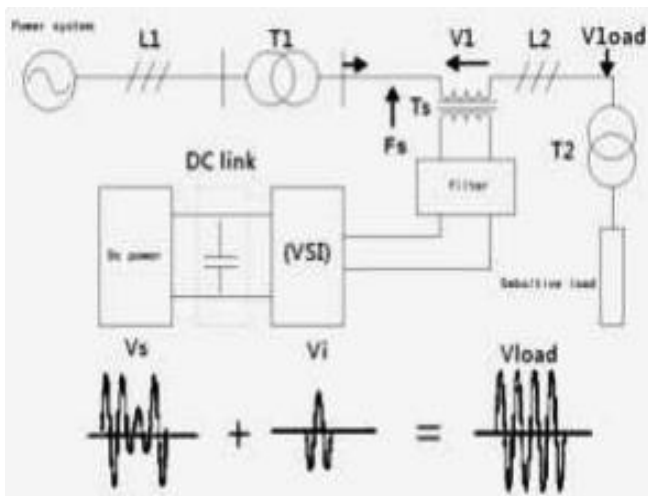


Fig.6: Restore Voltage

### 3. CONCLUSIONS

This problems caused by non-ideal bus voltages. These non idealities can be under-voltage, over-voltage, harmonics, shortages or sags. Although it does not seem so severe, every year large cost of lost production is paid by different manufacturers in the industry due to voltage sag, short periods of under voltage, up to a few hundreds of milliseconds. This project introduces detailed overview of Dynamic Voltage Restorer so that young electrical engineers come to know about such a modern custom power device for power quality improvement in future era.

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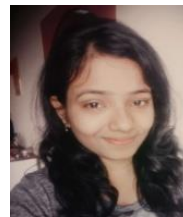
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