

# A Review For Voltage Sags And Swells Mitigation By Dynamic Voltage Restorer

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**Abstract :- In the Voltage Transmission Voltage Sags and Swells are the main factor which occurs at the time of transmission. Voltage Sags and Swells are the disturbances which increase the losses in the transmission and voltage get unstable. We can find these type of disturbance and remove that so that transfer voltage can be use in applications. Nonlinear loads and sensitive loads are affected by the Voltage Sags and Swells. DVR(Dynamic Voltage Restorer ) is the main and coast effective solution for reducing the losses from the Voltage Sags and Swells. DVR can protect the linear loads and sensitive loads from the Voltage Sags and Swells. In this paper, we are giving the Literature review for remove the Voltage Sags and Swells Issue at the transmission time.**

**Keywords-** *Dynamic Voltage Restorer (DVR), voltage sags, voltage swells, sensitive load.*

## I. INTRODUCTION

In the present time, Voltage Deviation gets occur during the load changes in power transmission. Due to the instability of Reactive Power, some limitations get occur in power transfer. In the standard power transmission system hundreds of generation, the station is connected along with thousands of load center. These are connected by a long power transmission line and a distribution network. The customer requires the good power quality which is required by the transmission line . Power distribution system will be able to provide continue and smooth sinusoidal waveform for the voltage frequency.

## II. VOLTAGE SAGS

Voltage Sags is defined in the IEE standard 1159-1995.

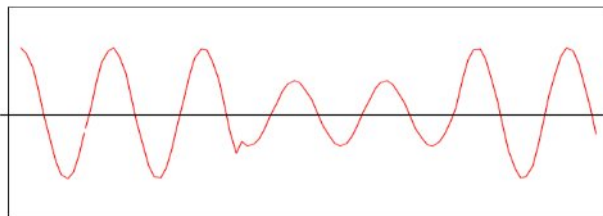


Fig 1 :- Voltage Sag- A reduced voltage for a limited period

Voltage Sags occur when the voltage get the decrease in RMS for the frequency of the power for the duration of 0.5 to 1 minute. Voltage Sags get the measure in depth from the original voltage . Sometimes voltage amplitude gets reduce for some time and exact required voltage graphs will not get as required . It gets decrease from some points, so it is called voltage Sags.

Voltage Sags occurs in given locations and points

- Utility system
- Inside Industrial plant

Below we mention some point by which the voltage Sags get occur

- Operation of Reclosers and circuit breaker
- Equipment Failure
- Bad Weather
- Pollution
- Animal & Birds
- Vehicle Problem
- Construction Activity
- Industrial Plants

## III. VOLTAGE SWELLS

Voltage Swells can be defined as the output voltage gets swell for the duration of 0.5 cycles to 1 minute from the nominal voltage than it is called voltage swells. Voltage Sag is important as compared to voltage swells. Because voltage swells get occur in the distribution system rarely.

## IV. LITERATURE REVIEW

*In 2015 Ch Sandhya[et.al]* presented a paper for show the issue which is getting by Voltage Sags and Swells. Voltage Sags and Swells give the effects on linear loads and sensitive loads. DVR (Dynamic Voltage Restorer) is a best coast effective solution for remove the problem for Voltage Sags and Swells for the protection of sensitive loads. The control of compensation voltage is based upon the DQO algorithm. The general configuration of the DVR consists of an injection or a booster transformer, a harmonic filter, a voltage source converter, DC charging circuit, a control and protection system.

**In 2014 S. Ganesh[et.al]** presented a paper for the distribution system , in which Sags are creating so much disturbances. Voltage Sags are occur due to the fault in the electrical network and it is also occur due to a large induction motor. This problem can be solved by dynamic voltage restorer(DVR). In this paper , they show the solution for remove Voltage Sags from the Voltage waveform. The DVR consists of VSC, injection transformers, passive filters and energy storage (lead acid battery). By injecting an appropriate voltage, the DVR restores a voltage waveform and ensures constant load voltage.

**In 2011 Mahmoud A. El-Gammal[et.al]** presented a paper for the solution of voltage Sags . For remove the problem of Voltage Sags they are giving the DVR (Dynamic Voltage Restorer) . DVR is a power electronic based device . It is providing three phase based controlled voltage source. DVR voltage vector magnitude and angle are added for the voltage of source when voltage sags occur . It is doing so that voltage drop can be resolve and voltage stability get stable . The DVR is designed for protecting the whole plant with loads in the range of some MVA. The DVR can restore the load voltage within few milliseconds. Several configurations and control methods are proposed for the DVR. In this paper, an overview of the DVR, its functions, configurations, components, compensating strategies and control methods are reviewed along with the device capabilities and limitations.

**In 2012 Ch Srisailam[et.al]** presented a paper for reduce the problem of voltage Sags and Swells by DVR (Dynamic Voltage Restorer). DVR is able to provide the proper voltage quality level which is requested by the customers. DVR will connect along with feeder in series at the medium voltage. The PI controller is very common in the control of DVRs. However, one disadvantage of this conventional controller is the fact that by using fixed gains, the controller may not provide the required control performance, when there are variations in the system parameters. To overcome this problem the fuzzy logic controller is proposed. And the simulation results have proved that the proposed control method greatly improves the performance of the DVR compared to the conventional PI controller.

**In 2014 Mayank Paliwal[et.al]** presented a paper for simulation results of mitigation voltage sags and swells . They are using DVR for reduce the problem of Voltage Sags and Swells in electrical power network. The dynamic voltage restorer with its excellent dynamic capabilities, when installed between the supply and a critical load feeder, can compensate for voltage sags/swells, restoring line voltage to its nominal value within few milliseconds and hence avoiding any power disruption to the load. In this paper the technical aspect feasibility related to the use dynamic voltage restorer (DVR) of traditional DC storage systems are evaluated. This topology would ensure a constant DC voltage across the DC link during the process of voltage compensation. The modeling of

dynamic voltage restorer is carried out component wise and their performances are analyzed using MATLAB software.

**In 2010 Tarek I. El-Shennawy[et.al]** presented a paper for give the solution from the problem of voltage Sags and Swells for the industries by DVR. DVR is solving the issue of voltage Sags along with all other losses of the distribution network. Existing configurations and control techniques for the DVR aim at protecting industries of high-tech, loads with adjustable speed drives and other power-electronic based loads. Industries with induction motors loads require a complete different approach for the design and control of a suitable DVR. Owing to the inherit inertia of the induction motors and their capability to withstand short-duration, shallow sags, in addition to its tolerance to phase jumps, a DVR with low cost, fast response and simple controller could be configured to fulfill the voltage restoration requirements.

**In 2014 Rasool M. Imran[et.al]** presented a paper for the issue of the power quality. Power Quality is the important issue for the power distribution system . In power quality system problems are coming like Voltage Sags and Swells for the low voltage power distribution system. We have lots of methods for the remove the problem of voltage Sags and Swells. One of the most popular methods of sag and swell compensation is Dynamic Voltage Restorer (DVR), The Dynamic Voltage Restorer (DVR) is series-connected power electronics based device. It provides advanced and economic solution to compensate voltage sag and swell. This device can be implemented to protect a group of medium or low voltage consumers. The new configuration of DVR has been proposed using improved d-q-0 controller. This study presents compensation of sags and swells voltage during single line to ground (SLG) and three-phase faults. A comprehensive study of a DVR as a powerful custom power device has been shown with aid of matlab/Simulink. The main advantages of DVR are low cost, simpler implementation, require less computational efforts and its control is simple as compared to other methods. The control system is based on dq0 technique which is a scaled error between source side of the DVR and its reference for compensating sags and swells. The paper simulation results shows that the DVR performance is efficient in mitigation of voltage sags and swells. The DVR handles both balanced and unbalanced situations without any difficulties. It injects an appropriate voltage component to correct any anomaly rapidly in the supply voltage; in addition, it keeps the load voltage balanced and constant at the nominal value.

**In 2013 G Mohan[et.al]** presented a paper for show the design of DVR (Dynamic Voltage Restorer) along with sinusoidal pulse width modulation (SPWM) and space vector pulse width modulation. It shows the problem of voltage Sags and Swells and shows the big impact on the sensitive loads and nonlinear nodes. DVR is a series connected device used for compensating the voltage sags & swells in distribution system. The detection of sags/swells is carried out with the help of dq0 theory, whereas the control of voltage source inverter is done with help of SPWM & SVPWM. This paper compares the

total harmonic distortion(THD) of the DVR using SPWM & SVPWM. The performance of DVR is studied under voltage Sag & Swells by using SPWM and SVPWM Techniques.

**In 2013 Shazly A. Mohammed[et.al]** presented a paper for show the problem of Voltage Sags and also that how much impact it is showing in sensitive loads. DVR(Dynamic Voltage Restorer) is the important device for reduce the problem of voltage Sags. The Dynamic Voltage Restorer (DVR) is fast, flexible and efficient solution to voltage sag problem. The DVR is a series compensator used to mitigate voltage sags and to restore load voltage to its rated value. In this paper, an overview of the DVR, its functions, configurations, components, operating modes, voltage injection methods and closed-loop control of the DVR output voltage are reviewed along with the device capabilities and limitations.

**In 2012 Anita Pakharia[et.al]** presented a paper for requirement of power quality. It is important issue for the customer of the distributed power . In the power transmission Voltage Sags and swells , notch , spike and transients get occur so we have to remove that for project transmission . The voltage sag and swell is very severe problem for an industrial customer which needs urgent attention for its compensation. There are various methods for the compensation of voltage sag and swell. One of the most popular methods of sag and swell compensation is Dynamic Voltage Restorer (DVR), which is used in both low voltage and medium voltage applications. In this paper, the comprehensive reviews of various articles, the advantages and disadvantages of each possible configuration and control techniques pertaining to DVR are presented. The compensation strategies and controllers have been presented in literature, aiming at fast response, accurate compensation and low costs. This review will help the researchers to select the optimum control strategy and power circuit configuration for DVR applications. This will also very helpful in finalizing the method of analysis and recommendations relating to the power quality problems.

**In 2011 Md. Riyasat Azim[et.al]** presented a paper for power quality issue. This issue is growing rapidly in the industries and residence electricity users. in the modern and recent technology sensitive power electronic equipment , control device and non linear loads are using to increase the efficiency of the distributed network . Voltage disturbances are the most common power quality problem due to this increased use of a large numbers of sophisticated and sensitive electronic equipment in industrial systems. The Dynamic Voltage Restorer (DVR) has recently been introduced to protect the sensitive industrial loads from the detrimental effects of voltage sags/swells and other voltage disturbances. Configurations and control schemes for the DVR varies depending upon the nature and characteristics of the load to be protected. Industries with induction motors loads require a complete different approach for the design and control of a suitable DVR owing to the inherit inertia of the induction

motors and their capability to withstand short-duration, shallow sags/swells, in addition to its tolerance to phase angle jumps. In this paper, a DVR with fast response, simple and efficient controller is proposed for fulfilling the voltage restoration requirements for industrial induction motor loads. The proposed DVR employs the classical Fourier Transform (FT) for sag/swell detection and quantification and a Fuzzy Logic based feedback controller which utilizes the error signal (difference between the reference voltage and actual measured load voltage) to control the triggering of the switches of an inverter using a Sinusoidal Pulse Width Modulation (SPWM) scheme. The proposed DVR utilizes the energy from available supply line feeders through a rectifier to feed the inverter.

**In 2012 S.F. Torabi[et.al]** presented a paper for show the working of the Dynamic Voltage Restorer (DVR). DVR is using to protect the distribution network from the voltage Sags and swells. In the Distribution system it will protect sensitive loads from the voltage Sags and Swells . The DVR can be implemented to protect a group of medium voltage or low voltage consumers. The new configuration of DVR has been proposed using improved d-q-0 controller technique. This study presents compensation of sags and swells voltage during single line to ground (SLG) fault and three-phase fault. The control system is based on DQO technique which is a scaled error, between source side of the DVR and its reference for compensating sags and swells. The simulation shows that the DVR performance is efficient in mitigation of voltage sags and swells.

**In 2013 priyanka Kumari [et.al]** presented a paper for the power quality which is getting important issue in the present time. In this paper , a sophisticated device is introduced so that the power quality performance can be improve. The major problem is get occur in the system that is Voltage Sags. To solve this problem, custom power devices are used. One of those devices is the Dynamic Voltage Restorer (DVR), which is the most efficient and effective modern custom power device used in power distribution networks. Its appeal includes lower cost, smaller size, and its fast dynamic response to the disturbance. It can provide the most commercial solution to mitigation voltage sag by injecting voltage as well as power into the system. This paper presents modeling, analysis and simulation of a Dynamic Voltage Restorer (DVR) using MATLAB. The efficiency of the DVR depends on the performance of the efficiency control technique involved in switching the inverters. In this model a PI controller and Discrete PWM pulse generator is used.

## V. CONCLUSION

In this paper , we are showing the solution for the Voltage Sags and Swells . We can use many types of methodology . DVR is the main method by which we can reduce the problem of voltage Sags and Swells. Voltage Sags and Swells are giving the main problem to the sensitive load in the distribution network.

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