“DVR FOR POWER QUALITY IMPROVEMENT BY USING SVPWM TECHNIQUE”: A REVIEW

Ms. Yashashri D. Pawar¹ and Ms. P. H. Pikle²

¹Student of Electrical Power System, Sau.Kamaltai Gawai Institute Of Engineering & Technology, Darapur
²Assistant Professor, Electrical Engg. Dept Sau.Kamaltai Gawai Institute Of Engineering & Technology, Darapur

Abstract— In this paper, the operation of DVR is presented and the control technique used for voltage source inverter is Space vector PWM. Space vector PWM techniques can utilize the better dc voltage and generates the fewer harmonic in inverter output voltage. Phase jump compensation is achieved by using Phase Locked Loop. This work describes the DVR based on Space Vector PWM incorporating the PLL provides voltage support to sensitive loads and is simulated by using MATLAB/SIMULINK. The control approach presented is able to compensate for any type of voltage sags and swells. This work also intended to assimilate the amount of DC energy storage depends on the installed load. Keywords- Voltage sag, SVPWM technique, DVR, Fuzzy Logic, PI controller.

1. INTRODUCTION

Power quality is related to the ability of utilities to provide electric power without interruption. One of the major concerns in electric industry today is power quality problems to sensitive loads. Power quality problems such as sag, swell, harmonic distortion, unbalance, transient and flicker may have impact on customer devices, cause malfunctions and also cost on loss of production. The high cost associated with these disturbances explains the increasing interest towards voltage sag mitigation techniques. Voltage sag is widely recognized as one of the most important power quality disturbances. Voltage sags can just occur frequently than any other power quality problem does. Therefore, the loss resulted due to voltage sag problem for customer at the load end is huge. Voltage sag is momentary decrease in rms voltage magnitude in the range of 0.1 to 0.9 per unit [9], [10], [11]. It is generally caused by faults in the power system and is characterized by its magnitude and duration. Voltage sag magnitude is defined as the net rms voltage during voltage sag, which is usually in per unit of the nominal voltage level. The voltage sag magnitude depends on various factors like the type of fault, the location of the fault and the fault impedance. The duration of voltage sag basically depends on how fast the fault is cleared by the protective device. In short, voltage sag will last till the fault is cleared. A swell is defined as an increase to between 1.1p.u and 1.8p.u in rms voltage or current at the power frequency durations from 0.5 to 1 minute [6], [7], [8]. A swell can occur due to a single line-to-ground fault on the system, which can also results in temporary voltage rise on the unfaulted phases. This is especially true in ungrounded or floating ground delta systems, where the sudden change in ground reference result in a voltage rise on the ungrounded phases. On an ungrounded generated by sudden load decreases and switching on a large Capacitor bank often causes an oscillatory transient. 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. The Dynamic Voltage Restorer (DVR) is a power electronic device that is used to inject 3-phase voltage in series and in synchronism with the distribution feeder voltages in order to compensate for voltage sag [4] and similarly it reacts quickly to inject the appropriate voltage component (negative voltage magnitude) in order to compensate voltage swell. In this work, voltage sag and swell is compensated using DVR based on Space Vector Pulse Width Modulation technique (SVPWM). It is found that DVR based on
Space Vector PWM technique (SVPWM) compensates voltage sags and swells effectively compared to Sinusoidal Pulse Width Modulation technique (SPWM). In a system, the line-to-ground voltages on the ungrounded phases will be 1.73p.u during a fault condition. Swells can also be

II. LITERATURE REVIEW

Performance of Dynamic Voltage Restorer (DVR) against Voltage sags and swells using Space Vector PWM Technique. P. Ananthababu, B. Trinadha, K. Ramcharan Dept of Electrical & Electronics, A U College of Engineering Andhra University, Visakhapatnam Published in 2009 IEEE. In this paper Power quality problem has been discussed and it has been observed that Voltage Sag & Swell are the most significant quality Problem. DVR has been proposed as a customer power device to mitigate the voltage Sag & Swell in the Power system. Two pulse width modulation based control techniques ie. Sinusoidal PWM and space vector PWM are presented for controlling the DVR.

Space vector pulse width modulation based DVR to mitigate voltage sag & swell. Uppunoori Venkata Reddy, Paduchuri Chandra Babu, IEEE Student Member, S.S.Dash Department of Electrical and Electronics Engineering SRM University, Kattankulathur Chennai, India. Published in 2013 IEEE. In this paper, the operation of DVR is presented and the control technique used for voltage source inverter is Space vector PWM. Space vector PWM techniques can utilize the better dc voltage and generates the fewer harmonic in inverter output voltage. Phase jump compensation is achieved by using Phase Locked Loop. This work describes the DVR based on Space Vector PWM incorporating the PLL provides voltage support to sensitive loads.

A Review of Compensating Type Custom Power Devices for Power Quality Improvement. Yash Pal, A. Swarup, Senior Member, IEEE, and Bhim Singh, Senior Member, IEEE Published in 2008. In this paper author presents a comprehensive review of compensating custom power devices mainly D-STATCOM, DVR and UPQC. It is aimed at providing a broad perspective on the status of compensating devices in electric power distribution system, classified references presented in this paper would serve quick and useful applications.

Minimization of voltage sag induced financial losses in distribution systems using FACTS devices. A.K. Goswami, C.P. Gupta, G.K. Singh, Department of Electrical Engineering, Indian Institute of Technology Roorkee, Roorkee 247667, Uttarakhand, India. Published in Elsevier 2010. This paper presented the modelling of FACTS devices to minimize the voltage sag induced financial losses. Two types of FACTS devices D-STATCOM AND SVC are used for mitigating of voltage sag. With D-STATCOM and SVC connected at particular bus the D-STATCOM provides better support to reduce the financial loss than SVC. D-STATCOM is giving 21.59% reduction in financial losses whereas SVC is giving 12.12% reduction in financial losses for highly sensitive equipment. In the case of medium sensitive equipment D-STATCOM is giving 50.74% reduction in financial losses whereas SVC is giving 35.12% reduction in financial losses.

Performance Enhancement of DVR for Mitigating Voltage Sag/Swell using Vector Control Strategy. Krischoonme Bhumkittipich, Faculty of Engineering, Rajamangala University of Technology Thanyaburi, Thailand, Natarajan Mithulananthan, School of Information Technology and Electrical Engineering, Brisbane, Australia. 2011 Published by Elsevier Ltd. Published by Elsevier Ltd. In 2011. In this paper dynamic voltage restorer (DVR) with vector control strategy for mitigating power quality in power distribution systems has been presented. Whenever there is voltage Sag/Swell occurrence DVR has to detect it and inject voltage components. The control strategy adopted for driving the DVRs plays a very important role in its performance and any delay in the process or incorrect injection would be harmful to sensitive loads that are vulnerable to voltage sag/swell.

III. RESEARCH MOTIVATION

Power quality is a significant tool of an electrical power system network. Now a day’s equipment are more sensitive to power quality. In power system there may be fluctuation in power
quality at the sensitive load due to faults and switching operation of breakers. This disturbance may result in failure of the equipment. Recent development in power electronic devices helps us to mitigate such problem. In this project DVR by using SVPWM method is used to maintain the power quality. This device can compensate the voltage unbalances efficiently.

**IV. RESEARCH OBJECTIVE**

For an economic operation of power system power quality should be maintained properly. Voltage sag/swell has been concerned as major power quality issue. The main objectives of this project are:-
1. Detection of voltage sag/swell in the power system network.
2. To mitigate the power quality issue using DVR by SVPWM and its behavioral study.
3. To select the best suitable control technique for DVR by SVPWM.
4. To control the device in order to obtain desired performance.

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**VI. CONCLUSION**

This work presents the power quality problems such as voltage sag and swell, consequences and mitigation techniques of Dynamic Voltage Restorer (DVR). The performance of dynamic voltage restorer against voltage sags and voltage swells using SVPWM Technique is presented. The highly developed graphic facilities available in MATLAB/SIMULINK were used to conduct all aspects of model implementation and to carry our extensive simulation studies on test system

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