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DESIGN & SIMULATION OF DYNAMIC VOLTAGE RESTORER FOR POWER QUALITY IMPROVEMENT

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Abstract – Power quality issues is a key issue in recent time where mainly the disturbances like voltage sag, voltage swell and faults are the mail causes. In this paper Dynamic Voltage Restorer (DVR) is implemented to mitigate the vulgate sag, swell and faulty disturbances. A dynamic voltage restorer (DVR) is a custom power tool used to correct the voltage sag by voltage as well as power injection. The DVR is a series type of compensating device implemented to alleviate voltage sags and swell and to reinstate load voltage to its normal value. Proposed technique is modeled in MATLAB-SIMULINK environment for getting the desired results.

Key Words: Flexible AC Transmission System, Electrical Power Quality, Voltage Sag, Voltage swell

1. INTRODUCTION:

Power quality is a very significant issue now days due to its impact on every unit of power system likes electricity suppliers, equipment manufactures and customers. "Power quality can be defined as deviation of voltage, current and frequency in a power system from normal value. It refers to a wide variety of electromagnetic phenomena that represent the voltage and current at a given time and at a given area within the power system. Because of the voltage deviation [1] the electrical utility is not able to supply the pure sinusoidal voltage of required magnitude and frequency. Voltage sags can occur at any instant of time, with amplitudes ranging from 10 – 90% and a duration lasting for half a cycle to one minute .Voltage swell, on the other hand, is defined as a swell is defined as an increase in rms voltage or current at the power frequency for durations from 0.5 cycles to 1 min.

1. DYNAMIC VOLTAGE RESTORER (DVR):

The basic structure of a DVR is shown in Fig.1. It is divided into six categories: (i) Energy Storage Unit: It is responsible for energy storage in DC form. Flywheels, batteries, superconducting magnetic energy storage (SMES) and super capacitors can be used as energy storage devices. It is supplies the real power requirements of the system when DVR is used for compensation [3]. (ii) Capacitor: DVR has a large DC capacitor to ensure stiff DC voltage input to inverter. (iii) Inverter: An Inverter system is used to convert dc storage into ac form [4]. Voltage source inverter (VSI) of low voltage and high current with step up injection transformer is used for this purpose in the DVR Compensation technique [3]. (iv) Passive Filters: Filters are used to convert the inverted PWM waveform into a sinusoidal waveform. This is achieved by eliminating the unwanted harmonic components generated VSI action. Higher orders harmonic components distort the compensated

Output voltage [2]. (v) By-Pass Switch: It issued to protect the inverter from high currents in the presence of faulty conditions. In the event of a fault or a short circuit on downstream, the DVR changes into the bypass condition where the VSI inverter is protected against over current flowing through the power semiconductor switches.

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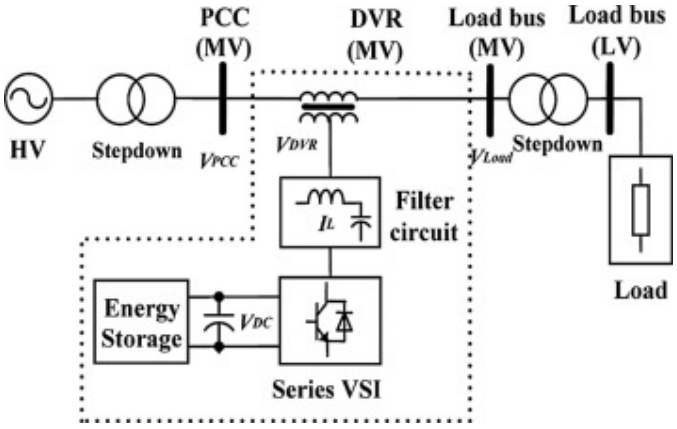

Fig.1 Structure of Dynamic Voltage Restorer DVR

3. PROPOSED MODEL

The developed model of three-phase DVR system and the proposed control scheme in the MATLAB/ SIMULINK environment is shown in Fig.6.1 and Fig.6.2. The performance of DVR is evaluated in terms of voltage harmonics mitigation, SAG and SWELL correction under different load conditions. The load under consideration is a combination of balanced linear loads. The performance of the proposed control scheme of three-phase DVR is evaluated for sinusoidal supply voltages as well as distorted supply mains.

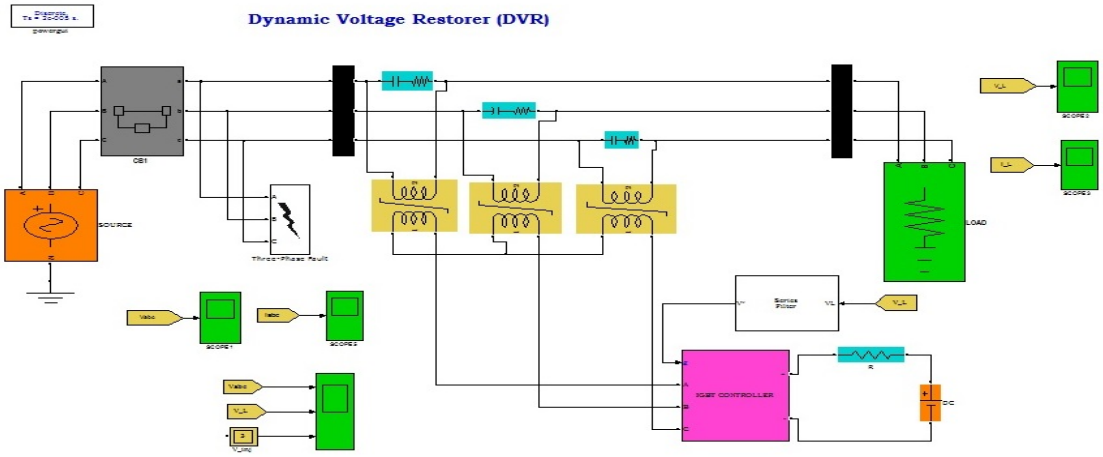

Fig.2 Performance of DVR for SAG Correction

Below figures shows the current and voltage waveform under sag swell and faulty conditions eith and without DVR.

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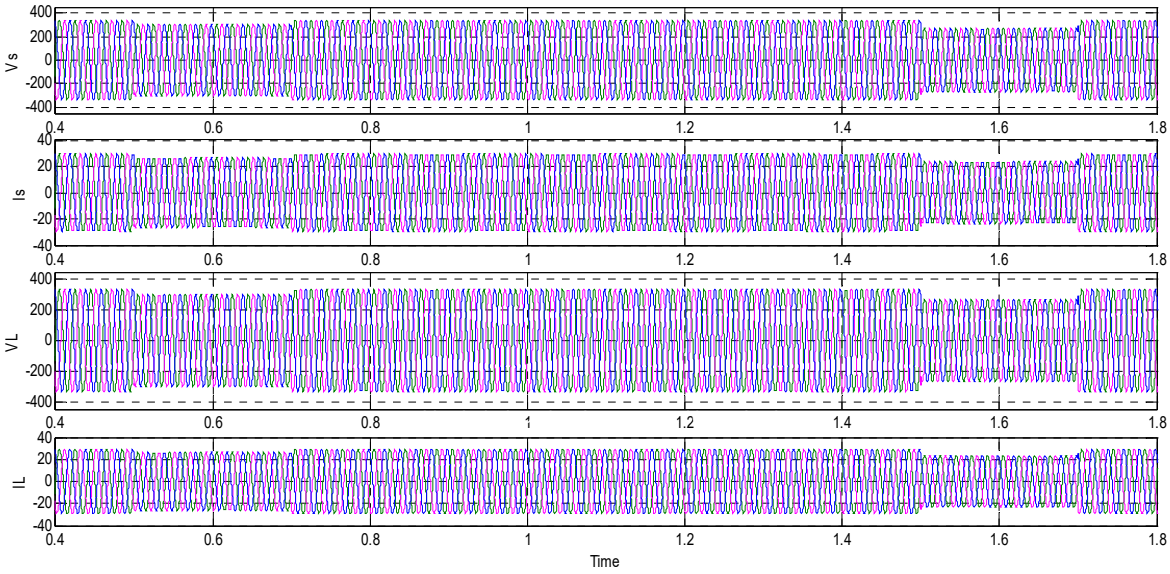

Fig.3 Result of Linear Load without DVR under SAG

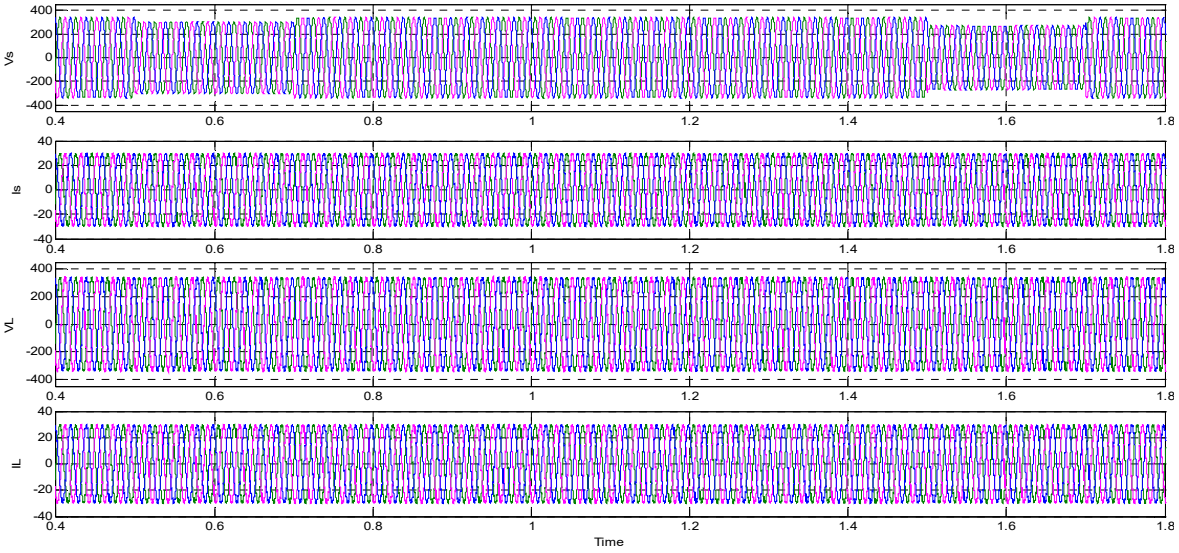

Fig.4 Performance of DVR for Sag Correction

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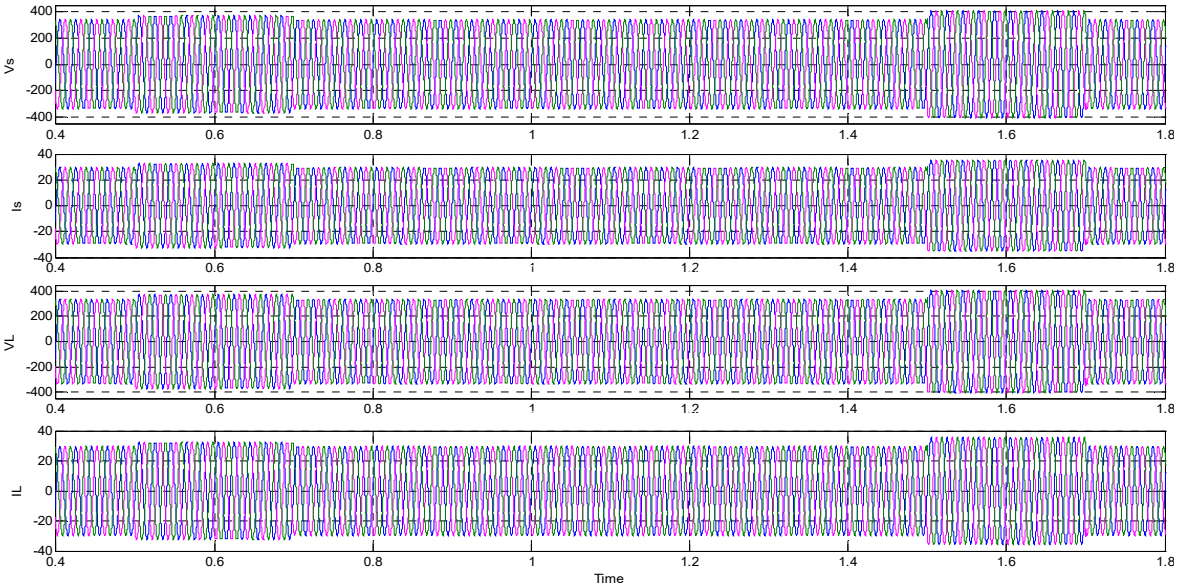

Fig.5 Result of Linear Load without DVR under SWELL

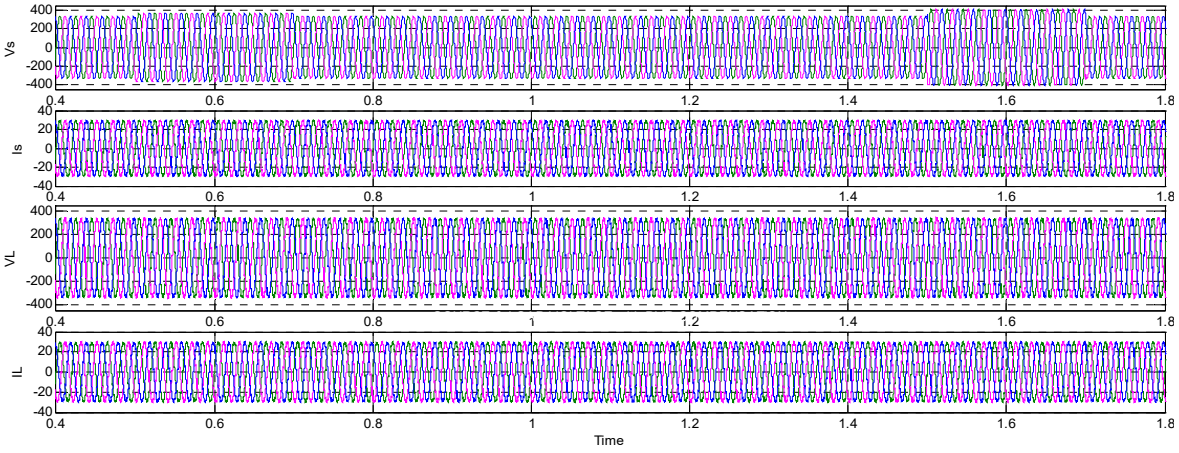

Fig.6 Performance of DVR for SWELL Correction

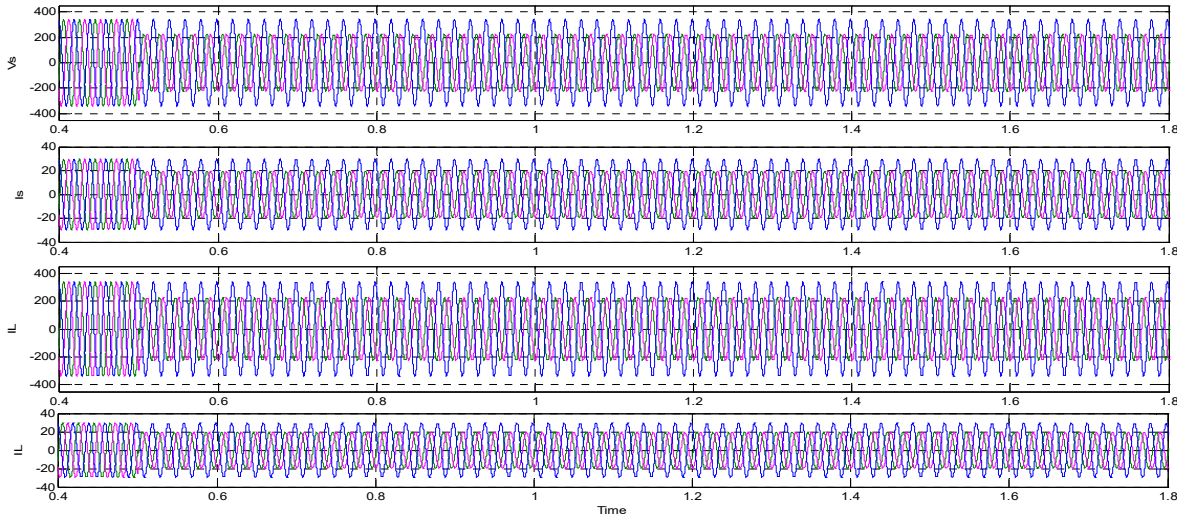

Fig.7 Result of Linear Load without DVR under L-L Fault

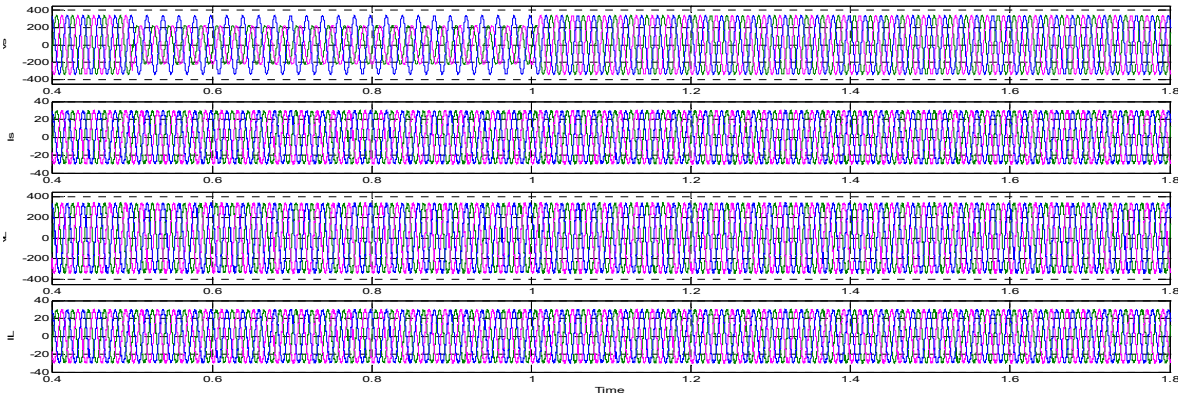

Fig.8 Result of Linear Load with DVR under L-L Fault

4. CONCLUSION:

This paper presents a comprehensive survey of previously reported literature for mitigation of sag and swells by implementing dynamic voltage restorer (DVR). Also an overview of dynamic voltage restorer (DVR) is presented. DVRs are effective recent custom power devices for voltage sags and swells compensation. They inject the appropriate voltage component to correct rapidly any anomaly in the supply voltage to keep the load voltage balanced and constant at the nominal value. The Dynamic Voltage Restorer (DVR) is considered to be an efficient solution due to its relatively low cost and small size; also it has a fast dynamic response.

[1] G Mohan1 (M.Tech), Prof. A Lakshmi Devi2 Design and Simulation of Dynamic voltage restorer (DVR) using SPWM and SVPWM Techniques for Voltage Sags &Voltage Swells Mitigation International Journal of Modern Engineering Research (IJMER Vol. 3, Issue. 6, Nov - Dec. 2013 pp-3469-3475

[2] C. Zhan, M. Barnes, V.K. Ramachandaramurthy, and N. Jenkis, "Dynamic Voltage Restorer with Battery Energy Storage for Voltage Dip Mitigation" Power Electronics and Variable Speed Drives, 18-19, Conference Publication No. 475, IEE September 2000.

[3] Kasuni Perera, Daniel Salomon son, Arulampaiam, Atputharajah, Sanath Alahakoon, "Automated Control Technique

for A Single Phase Dynamic Voltage Restorer" IEEE, 2006.

[4] S. V Ravi Kumar, S. Siva Nagaraju, "Simulation of D-Statcom and DVR in Power Systems" ARPN Journal of Engineering and Applied Sciences Vol. 2, No. 3, June 2007.

[1] R. Amrita, and A. K. Nadir "Modeling & Simulation of dynamic voltage restorer (DVR) for enhancing voltage sag", Sensors & Transducers Journal, Vol. 87, Issue 1, January 2008, pp. 85-93, 2008.

[5] W. Jing, X. Aiqin, S. Yueyue, "A survey on control strategies Of Dynamic Voltage Restorer", 13th IEEE International Conference on harmonics and quality of power, pp. 1 – 5, 2008.

[6] Suxuan Guo, "Fast repetitive controller based low-voltage Dynamic Voltage Restorer for Voltage-Quality Issues in Distribution System", 2010 2nd IEEE International Symposium on Power Electronics for Distributed Generation Systems, pp. 988 – 992, 2010.

[7] Biricik, S., Khadem, S. K., Redif, S., & Basu, M. (2014, June). Control of the Dynamic Voltage Restorer to improve voltage quality. In Power Electronics for Distributed Generation Systems (PEDG), 2014 IEEE 5th International Symposium on (pp. 1-5). IEEE.