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VOLTAGE SAG COMPENSATION USING A DYNAMIC VOLTAGE RESTORER WITH PHASE JUMP

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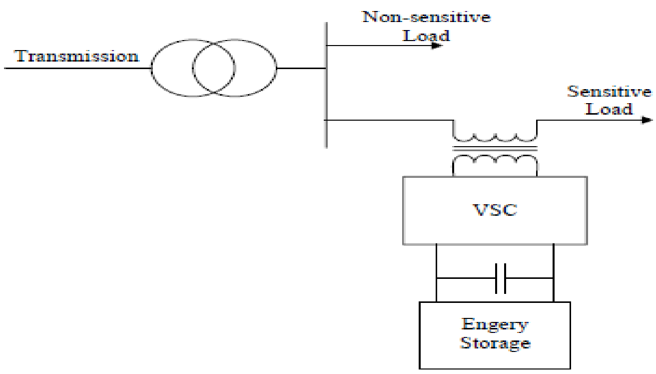
Abstract – *In this paper voltage sags compensation employing dynamic voltage restorer with phase jump is designed and simulated. The model is often simulated by MATLAB/SIMULINK. Control strategies for a dynamic voltage restorer are examined with a stress emphasis on the compensation of voltage sags with phase jump. An appropriate compensating voltage series injection is harder to achieve. Voltage sags with phase jumps are in some instances more to trip loads. A Dynamic Voltage Restorer may be a series-connected device and therefore the main purpose of this device is to guard sensitive loads from sags/swells and interruptions within the supply side. This is often accomplished by rapid series voltage injection to catch up on the drop/rise within the supply voltage.*

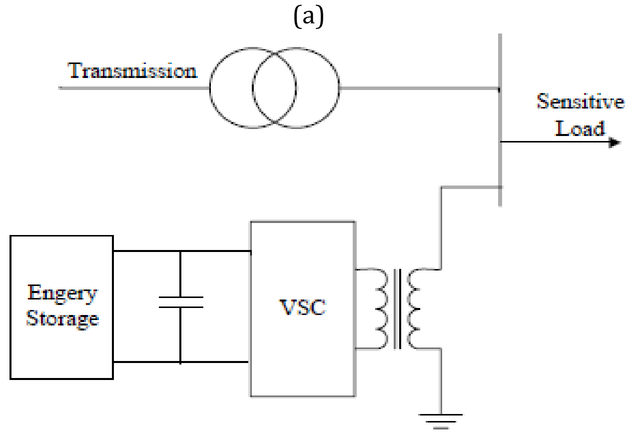
Key Words: Dynamic Voltage Restorer (DVR), Power quality, Voltage Sags Mitigation, Phase jump

1.INTRODUCTION

High-technology equipment associated with on-line service, advanced control, communication, precise manufacturing techniques and automation features a significant influence on Power quality. Transients, sags, interruptions and other distortions to the sinusoidal waveform include power quality problems. Voltage sag is one among the foremost important power quality issues that's a sudden short duration reduction in voltage magnitude between 10-90% compared to nominal voltage. Momentary decrease within the RMS voltage with duration starting from half a cycle up to at least one minute is termed as voltage sag. For instance products of semiconductor fabrication, with considerable financial losses voltage sags can have a deleterious influence thereon. Significant costs occur within the proliferation of voltage-sensitive computer-based and variable speed drive loads due to Deep voltage sags, even of relatively short duration. Studies have shown that transmission faults, while relatively rare, can cause widespread sags which will constitute a serious source of process interruptions for very long distances from the faulted point. The resulting sags are more limited in geographic extent due to considerably more Distribution faults. Nominal voltage is within 40% of the bulk of voltage sags. Therefore, by designing drives and other critical loads capable of riding through sags with magnitude of up to 40%, interruption of processes are often reduced significantly. Faults in either the transmission or the distribution system can correct sags from DVR.



(a)



(b)

Figure 1 schematic of Interconnection (a) series (b) shunt compensation power quality improvement

2. DYNAMIC VOLTAGE RESTORER

Figure 2 shows Schematic diagram of DVR, it's the foremost efficient and effective modern custom power device used in power distribution networks is one of those device utilized in recent times. DVR is generally installed during a distribution system between the availability and therefore the critical load feeder at the point of common coupling (PCC). Voltage sags, swells and provided voltage unbalances are the foremost severe disturbances among the power quality problems.

The DVR general configuration consists of:

1. An Injection transformer
2. A Harmonic filter
3. Storage Devices
4. A Voltage Source Converter (VSC)
5. DC charging circuit
6. A Control and Protection system

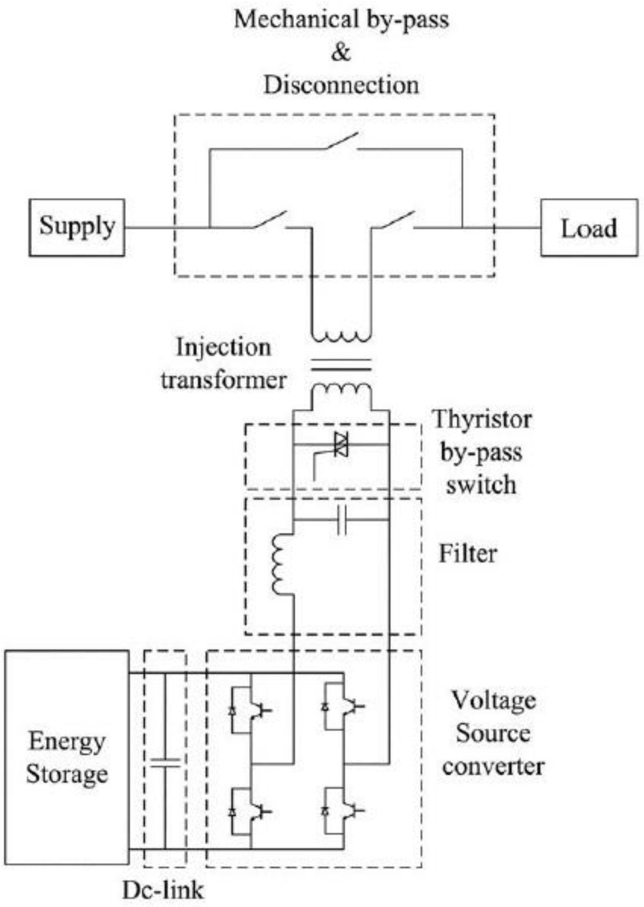


Figure 2 DVR Schematic Diagram

2.1 AN INJECTION / BOOSTER TRANSFORMER

1. It connects the DVR to the distribution network.
2. The aim of the Injection / Booster transformer serves isolating the load from the system (VSC and control mechanism).

2.2 HARMONIC FILTER

The harmonic voltage content generated by the VSC is often kept within permissible level by harmonic filters.

2.3 STORAGE DEVICES

The necessary energy to the VSC is often done by storage devices to provide via a dc link for the generation of injected voltages. Capacitance, batteries and Superconductive magnetic energy storage (SMES) are the various sorts of energy storage devices.

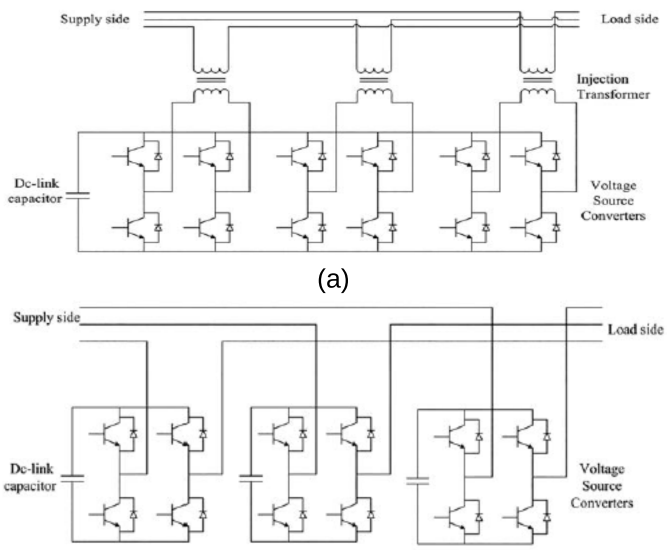
2.4 VOLTAGE SOURCE CONVERTER

The VSC is employed to temporarily replace the availability voltage or to get the part of the availability voltage which is missing within the DVR. MOSFET, IGCT, GTO and IGBT are the most switching devices. So as to create VSC with very large power ratings, IGCT has enhanced performance and reliability.

2.5 DC CHARGING CIRCUIT

The two main tasks DC Charging Circuit has done.
1. After a sag compensation event, charge the energy source.
2. At the nominal dc link voltage to maintain dc link voltage.

This paper briefly describes voltage sags with a phase jump strategies for a DVR, some limitations of the control strategies are also included. The DVR must also be able to differentiate between the voltage sags and background power problems. The control of a DVR is not direct because of the variation in the type of connected load, wide variation in the nature of sags that require compensation, and necessity of immediate reaction. Sags are frequently nonsymmetrical and phase jump.



(b)

Figure 3(a) & (b) DVR topologies supported isolation

Figures 3(a) and 3(b) shows transformer connected and transformer less DVR topologies. Phase to- phase short circuit scenario is often avoided by independent *dc*-links in conjunction with each inverter. Cascaded switches /inverter connections to bring the voltage boost function are the modifications introduced within the transformer less DVR compared to the traditional DVR scheme.

By Introducing separate *dc*-links for each inverter within the transformer less DVR, the shortcoming of conduction overlapping of the switches is addressed. Cost reduction within the DVR systems includes converters with reduced switch count, supply side or load side connected DVRs and therefore the transformer less DVR topology are the available possibilities.

3. SIMULATION AND DISCUSSION

The MATLAB model of the DVR connected system is shown in Figure 4. So as to get sag in supply side, a three-phase programmable voltage source is connected to the three phase non-linear load through the DVR. DVR is modeled and simulated using the MATLAB Simulink software.

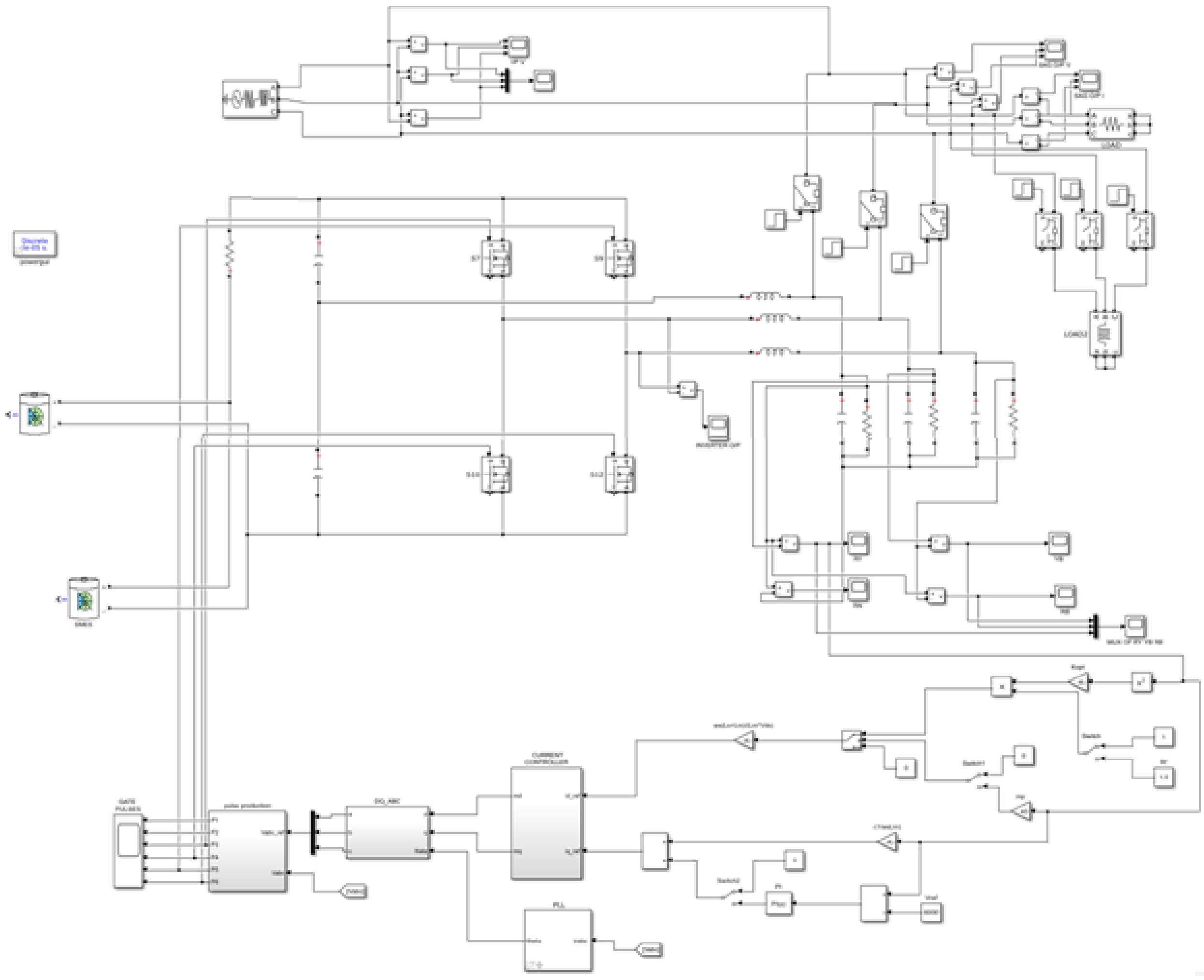


Figure 4 Simulation circuit –DVR with Mitigation of Voltage Sags with Phase Jump

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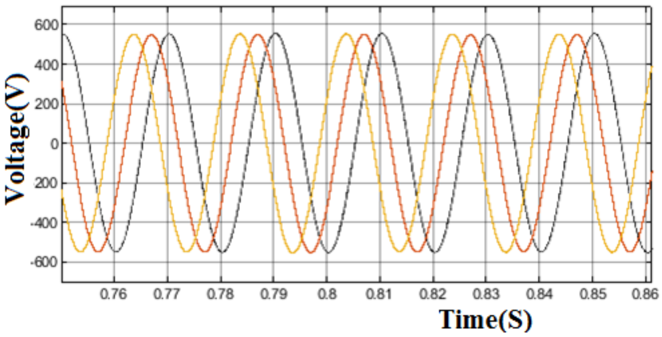

Figure 5 Three Phase Input voltage

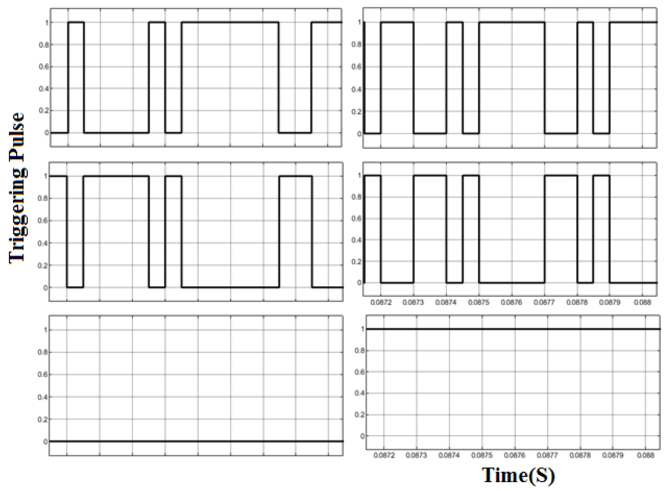

Figure 6 Trigger pulse

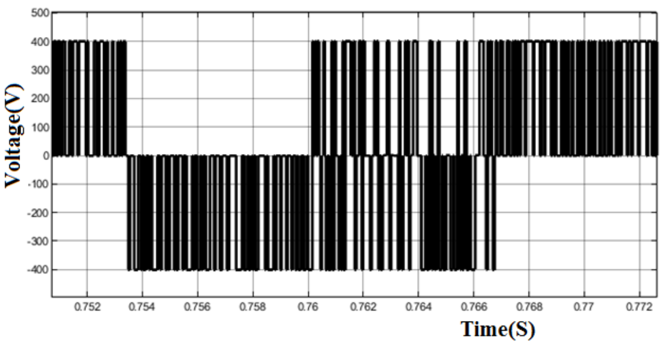

Figure 7 Converter Output Voltage

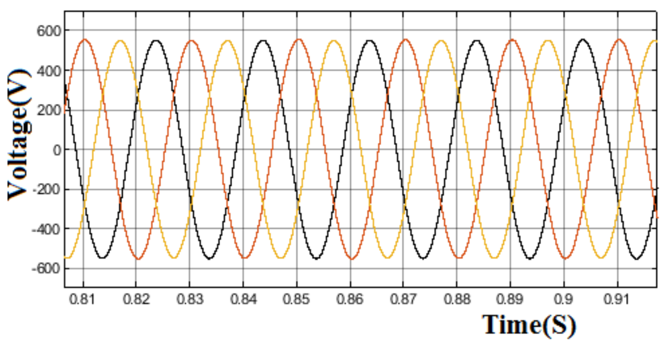

Figure 8 Three Phase Input Line voltage

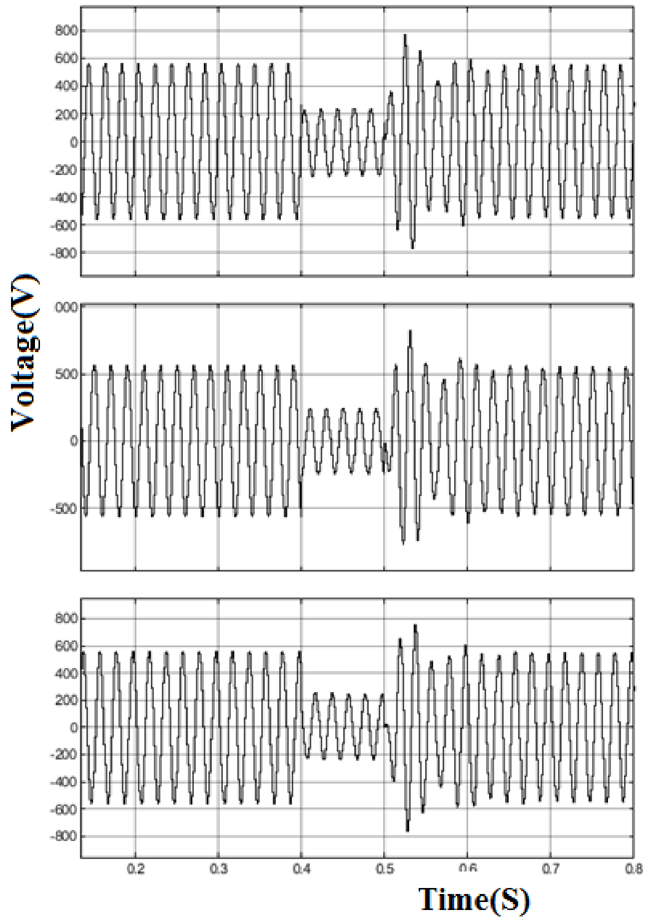

Figure 9 Sag output voltage(single phase)

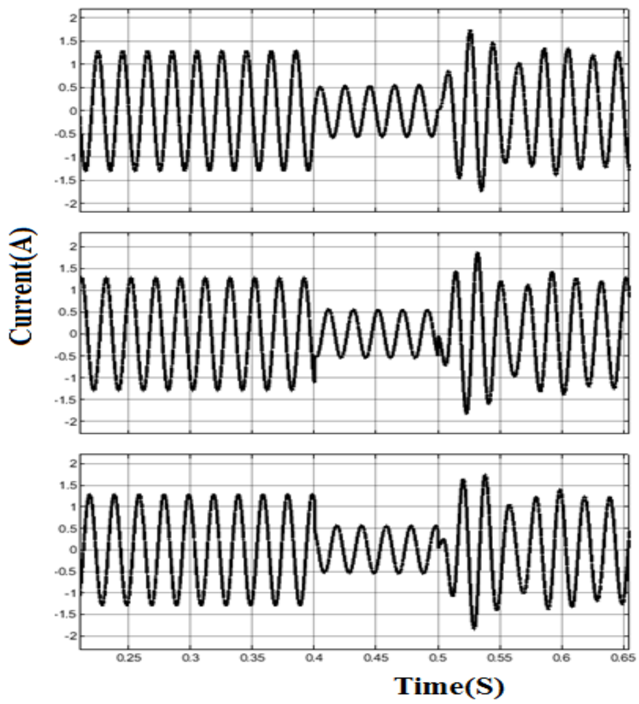

Figure 10 Sag output Current (single phase)

4. CONCLUSION

The control of a DVR was examined and was placed on DVR control strategies that eliminate propagation of voltage sags or phase shifts to the load. Control methods that protect the load from voltage sag with phase jump were explored through simulation in MATLAB/SIMULINK. Control methods might be employed by a DVR to mitigate voltage sags with phase jump that occur on systems. This method includes compensation during the sag and therefore load voltage remains undisturbed by voltage sag.

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BIOGRAPHIES

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