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DVR BASED ON THREE PHASE MULTI LEVEL INVERTER

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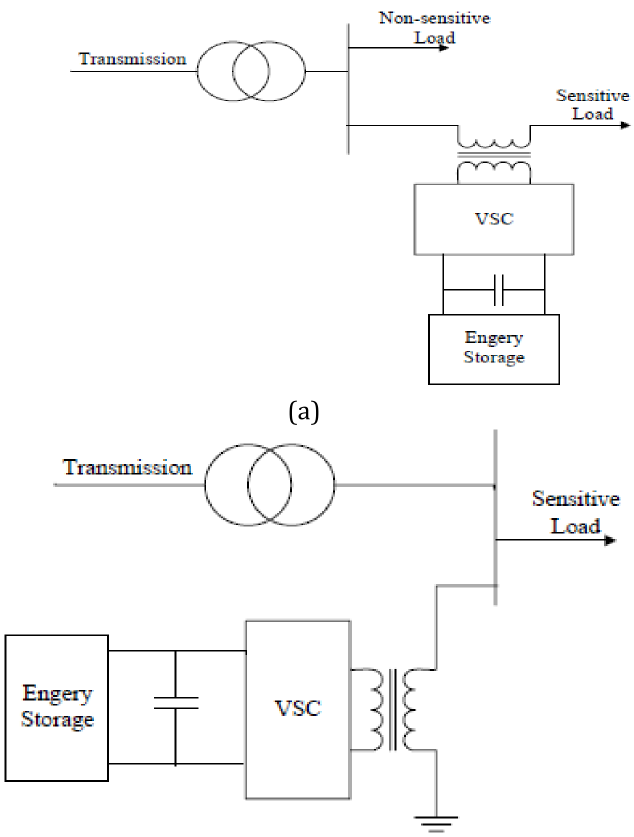
Abstract – *In this paper DVR based on three phase cascaded multilevel converters is designed to maintain the load voltage within acceptable levels. The dynamic voltage restorer as a way of series compensation of voltage sags has become established as a preferred approach for improving power quality at sensitive load locations. Meanwhile, the cascaded multilevel type topology in high power applications has become a workhorse of power converter topology. The system operation and controller design approaches are verified using MATLAB simulations.*

Key Words: Dynamic Voltage Restorer (DVR); cascaded H-bridge multilevel inverter; hysteresis controller

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. The fraction of load that‘s sensitive to low voltage is predicted to grow rapidly within the coming decades. 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 configurations

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

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.

Figure 3 shows the single-phase configuration of a CHB–DVR. The input, DC-link and output modules are three modules of the CHB–DVR. This paper briefly describes, the 5-level DVR supported three phase multilevel inverter. Increase the efficiency of the inverter operation and reduce the THD level within the operation of inverter are often achieved by multilevel inverter circuit which is employed. Diode clamped, capacitor clamped and cascaded multilevel inverter are three sorts of topologies in multilevel inverter. It's cheaper in cost compared with transformer combined structure due to H-bridge structure takes no dc to dc boost converter and no additional transformer connection. Multilevel converter has several DC sources to AC output voltage.

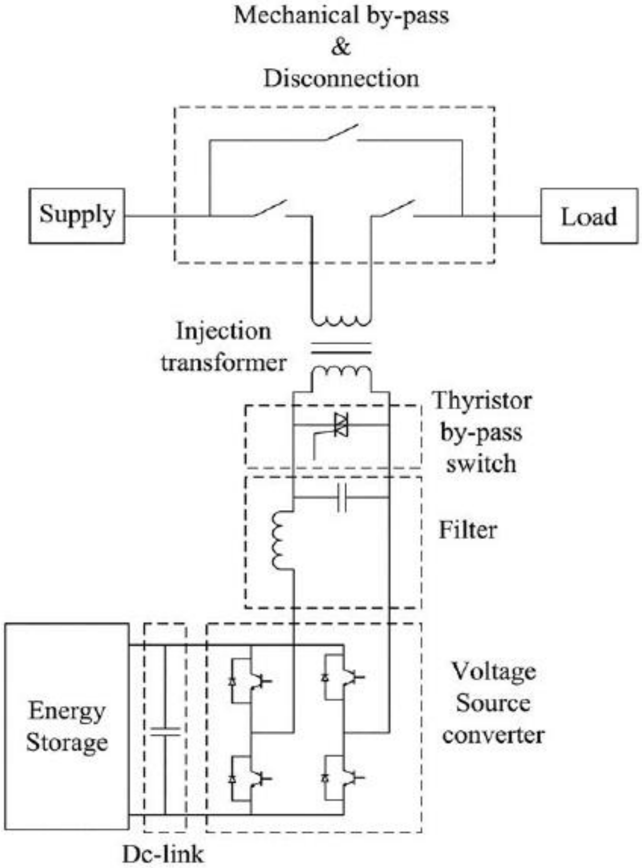


Figure 2 DVR Schematic Diagram

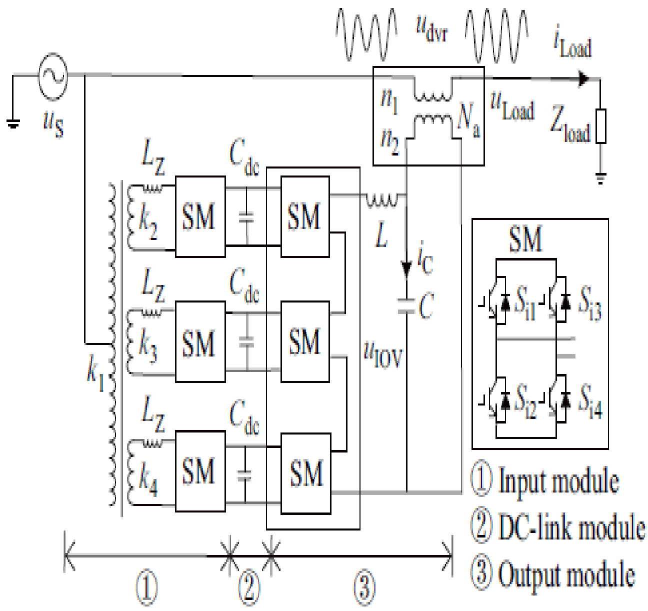


Figure 3 H bridge-DVR topologies

4. SIMULATION AND DISCUSSION

Cascaded H-bridge inverter based DVR is modeled and simulated using the MATLAB /Simulink by Sim-Power System toolboxes. The MATLAB model of the DVR connected system is shown in Figure 4.

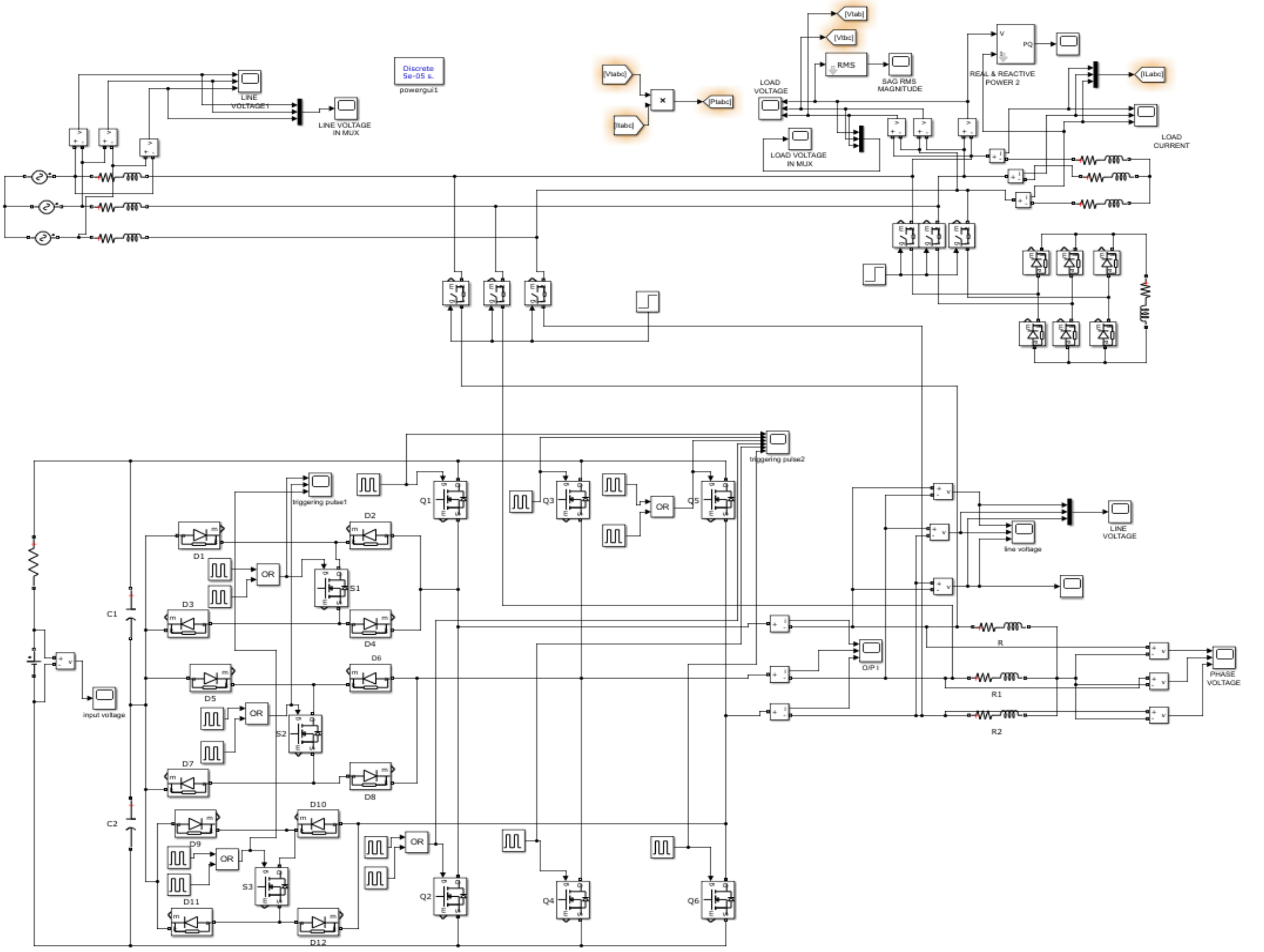


Figure 4 Simulation circuit for Cascaded H-bridge inverter based DVR

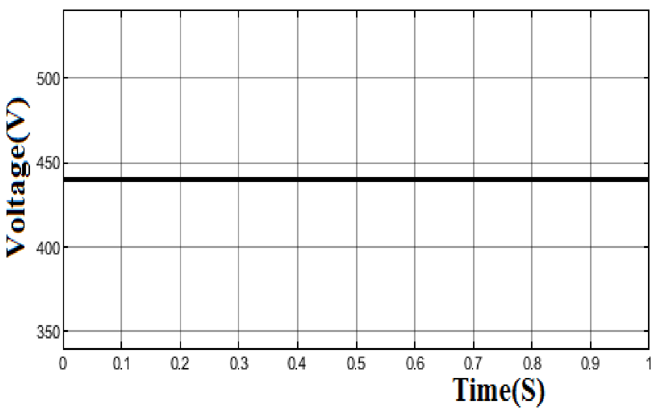


Figure 5 Input voltage

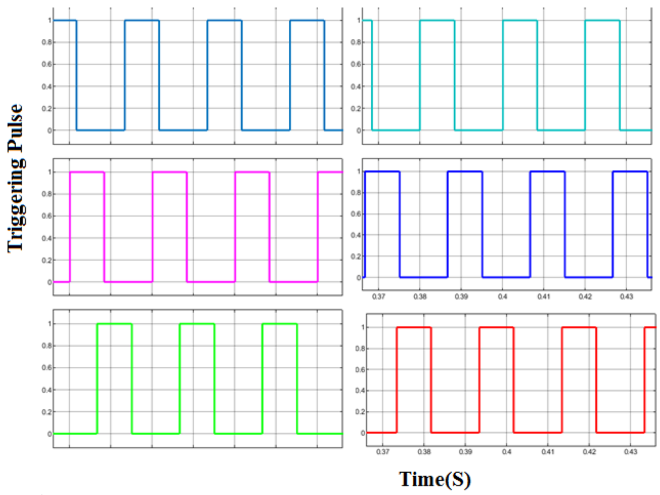


Figure 6 Trigger pulse

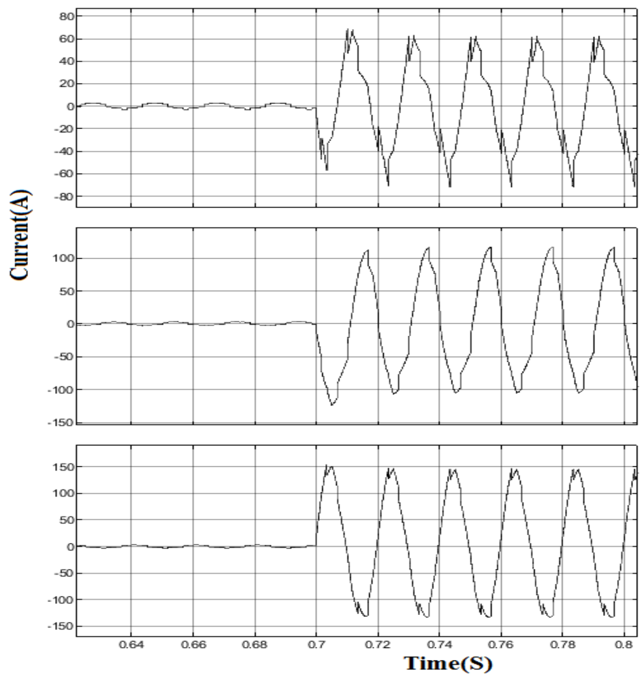


Figure 7Output current at each phase

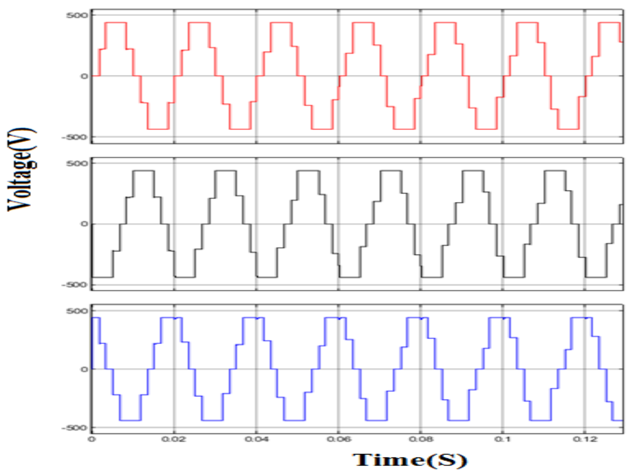


Figure 8 output Line voltage(single phase)

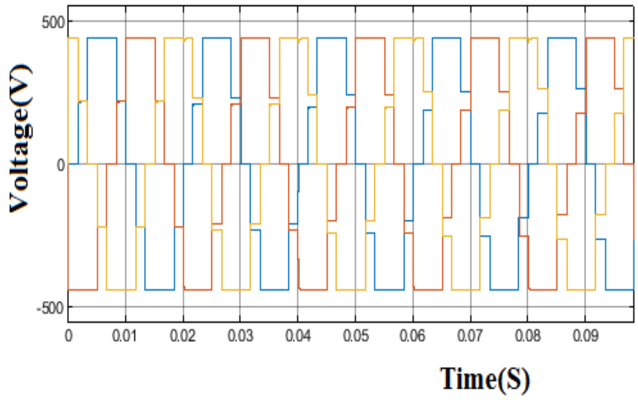


Figure 9 Three Phase output Line voltage

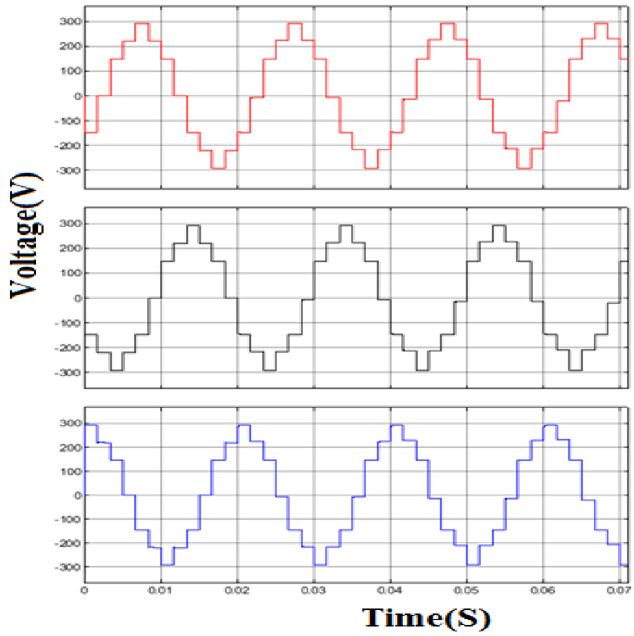


Figure 10 output phase voltage(single phase)

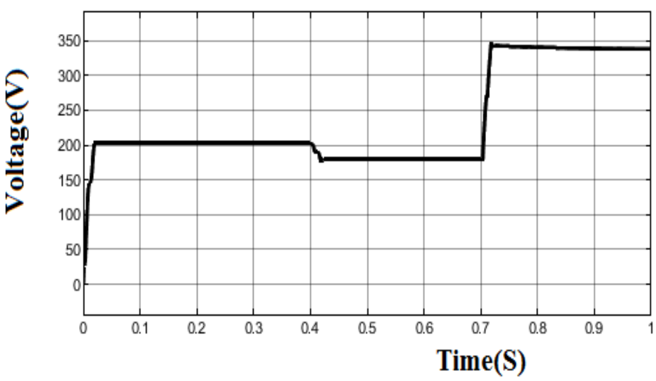


Figure 11 Output Sag Voltage

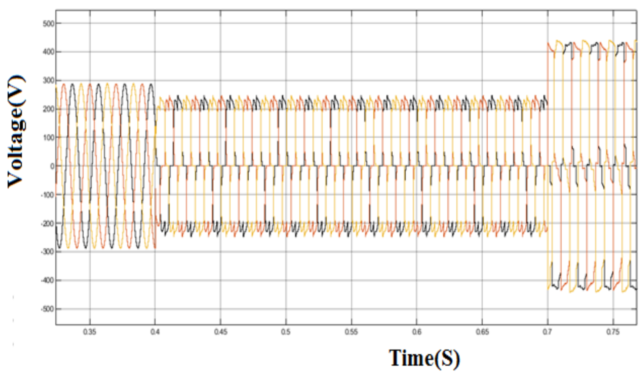


Figure 12 Output voltage

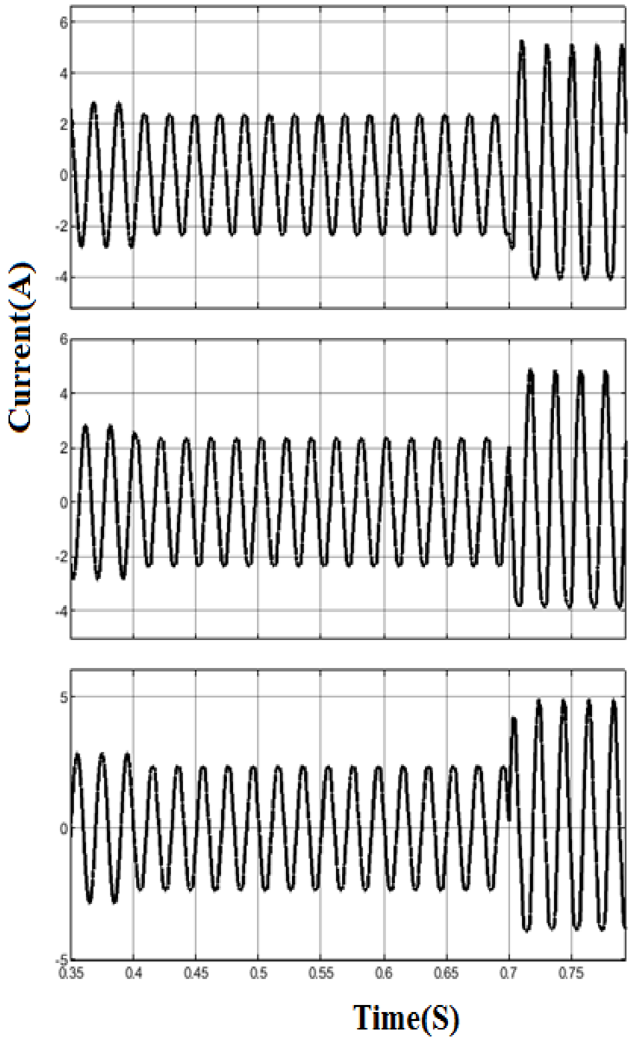


Figure 13 Output Load voltage

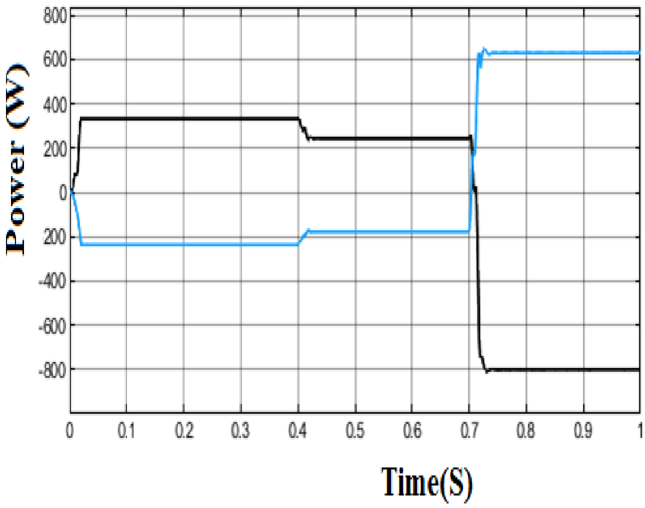


Figure 14 Active and Reactive Power

5. CONCLUSION

In this paper the detailed design of a closed loop system regulator to take care of the load voltage within acceptable levels during a DVR using cascaded multilevel converters was designed and simulated and its output characteristics are studied using Matlab/Simulink. DVR is employed to regulate load voltage and determine switching signals for inverter switches and featured a in no time response, simple operation and variable switching frequency. Excessively sizable amount of bulky transformers required by conventional multilevel inverters can be eliminated by H-bridge inverter. In presence of voltage sag/swells, compensate for the availability system and protects the foremost critical load against voltage sags by the DVR injects voltage altogether three phases.

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BIOGRAPHIES

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