

Hysteresis Theory to Mitigate Voltage SAG and SWELL Without Maintaining DC Link Voltage

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ABSTRACT: DVR (Dynamic Voltage Restorer) is a device that has seen applications in a variety of transmission and distribution systems. It is a series compensation device, which protects sensitive electric load from power quality problems such as voltage sags, swells, unbalance and distortion through power electronic controllers that use voltage source converters (VSC). but the main problem In DVR is to control the injection voltage to the grid and large amount filter size is needed. A series compensation to improve the voltage property of loads intended for optimal utilization of a dynamic voltage restorer (DVR). The sag and swell are compensated in series injection mode. The HYSTERISIS reference frame theory is used to compensate the SAG and SWELL. In this control technique without maintain the DC link voltage.

KEYWORDS: DVR, SAG, SWELL, Hysterisis theory, VSC, DC link voltage

I. INTRODUCTION

Power quality may be defined as any power problems manifested in voltage, current or frequency deviations that results in failure or mis -operation of customers equipment. Both electric utilities and end users of electrical power are becoming increasingly concerned about the quality of electric power. Power quality is an umbrella concept for multitude of individual types of power system disturbances. The issues that fall under this umbrella are not necessarily new. What is new is that engineers are now attempting to deal with these issues with a systems approach rather than as individual problems. One important and noticeable change seen is that the quality of electricity supplied is now subject to legislation which considers it to be no different from other goods and services. Just a few years ago, momentary power outages, sags, swells, surges had relatively little effect on most industrial processes. Today, manufacturing systems, sensitive telemetry, and precision electronic equipment can be disturbed, halted, or even damaged by voltage sag of two or three electrical cycles . Production losses can soar. Power Quality problems evidence themselves in a variety of ways such as: Computer shut down, malfunction of errors, PLC (Programmable Logic Controller) malfunction or errors, variable speed drives tripping out, racing or blinking digital clocks, etc. These can give problems ranging from inconvenience to loss of manufacturing capability with substantial loss in income Understanding Power Quality and the range of associated problems becomes very important to mitigate the problems. The ideal power supply to a low voltage customer is 240 / 415 V at 50 Hz with a sinusoidal wave shape. The electricity supplier through his local network cannot keep the supply exactly at the ideal due to a range of disturbances outside its control and attempts to maintain its voltage within specified ranges. Frequency, Voltage and Waveform events are the basic types of power quality disturbances. The frequency of a power system is established by the rotational speed of the power station generators and it is very rare that this frequency is significantly varied and it is not further discussed in this paper. Waveform events result in distortion of the normal sinusoidal wave shapes of the mains voltage. Harmonics, Inter-harmonics, notching, transients, noise disturbance etc. and these are mostly caused by the consumers of electricity due

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to their equipment, particularly power electronic related equipment and induction motors. These are also not further discussed in this paper. The third type of power quality disturbance, viz, Voltage events are considered in this paper. The role and certain design aspects of Dynamic Voltage Restorer (DVR) to mitigate the power quality problems related with the voltage events are presented here. The voltage is normally held in the range of $\pm 6\%$ Voltage sag/swell that occurs more frequently than any other power quality phenomenon is known as the most important power quality problems in the power distribution systems. And Voltage sag is defined as a sudden reduction of supply voltage down 90% to 10% of nominal. According to the standard, a typical duration of sag is from 10 ms to 1 minute. On the other hand, voltage swell is defined as a sudden increasing of supply voltage up 110% to 180% in rms voltage at the network fundamental frequency with duration from 10 ms to 1 minute Voltage sag/swell often are caused by faults such as single line-to-ground fault, double line-to ground fault on the power distribution system or due to starting of large induction motors or energizing a large capacitor bank. Voltage sag/swell can interrupt or lead to malfunction of any electric equipment which is sensitive to voltage variations

II. LITERATURE REVIEW

In 2013 Zainal Salam; Abdul Moeed Amjad; Ahmed Majed Harmonic elimination pulse width modulation (HEPWM) method has been widely applied to remove harmonics due to its superior frequency spectra. It requires the solution of a set of transcendental nonlinear equations. Soft computing (SC) methods are extensively employed to solve this problem because of their effective global search ability. Differential evolution (DE) has surpassed most of the SC methods in diverse fields but it has never been utilized to solve this problem. In this work, DE is utilized to solve the HEPWM problem for five level cascaded multilevel voltage source inverter (MVSI). Simulation results have shown that the discontinuities of the HEPWM angle trajectories are nullified and a wider over-modulation range has been covered, enhancing the utilization of DC link voltages and extending the application of HEPWM for high power applications.

In 2014 Gaetano Patti; Giuliana Alderisi; Lucia Lo Bello The Low Latency Deterministic Network (LLDN) protocol is defined in the IEEE 802.15.4e, which is an amendment to the IEEE 802.15.4 standard specifically devised to support the requirements of industrial applications. The LLDN provides a TDMA-based medium access mechanism in which the network cycle time grows linearly with the number of nodes. As a result, to offer low cycle times to applications requiring a high number of nodes, the LLDN specifications suggest to create multiple networks operating on different channels by embedding multiple transceivers in the coordinator. However, such an approach entails high costs and increases the design complexity. Moreover, the LLDN protocol foresees a star topology that limits the network area coverage. This paper proposes a novel approach, called a MultiChannel LLDN, based on a hierarchical network structure in which nodes communicate on different channels at the same time

III. PROPOSED SYSTEM

A. POWER SUPPLY UNIT

As we all know any invention of latest technology cannot be activated without the source of power. So in this fast moving world we deliberately need a proper power source which will be apt for a particular requirement. All the electronic components starting from diode to Intel IC's only work with a DC supply ranging from -5V to $+12\text{V}$. We are utilizing for the same, the most cheapest and commonly available energy source of 230V-50Hz and stepping down, rectifying, filtering and regulating the voltage. This will be dealt briefly in the forthcoming sections. The basic idea of a DVR is to inject the missing voltage cycles into the system through series injection transformer whenever voltage sags are present in the system supply voltage. As a consequence, sag is unseen by the loads. During normal operation, the capacitor receives energy from the main supply source. When voltage dip or sags are detected, the capacitor delivers DC supply to the inverter.

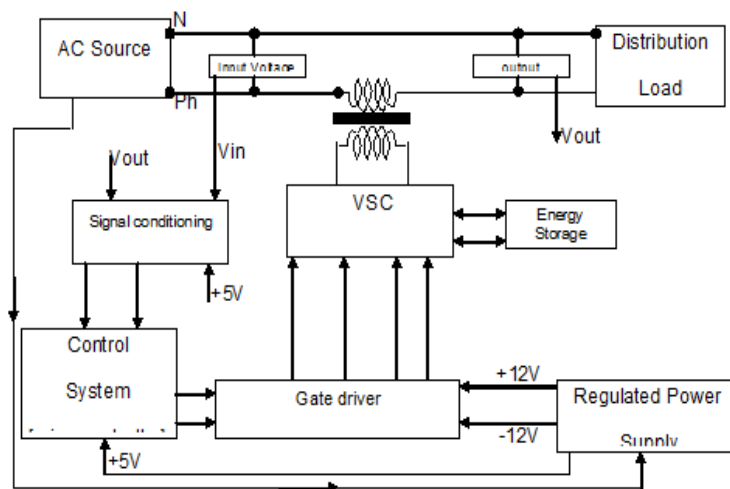
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Proposed Block Diagram



B STEP DOWN TRANSFORMER

When AC is applied to the primary winding of the power transformer it can either be stepped down or depending on the value of DC needed. In our circuit the transformer of 230v/15-0-15v is used to perform the step down operation where a 230V AC appears as 15V AC across the secondary winding . One alteration of input causes the top of the transformer to be positive and the bottom negative. The next alteration will temporarily cause the reverse. The current rating of the transformer used in our project is 2A. Apart from stepping down AC voltages , it gives isolation between the power source and power supply circuitries

C. RECTIFIER UNIT

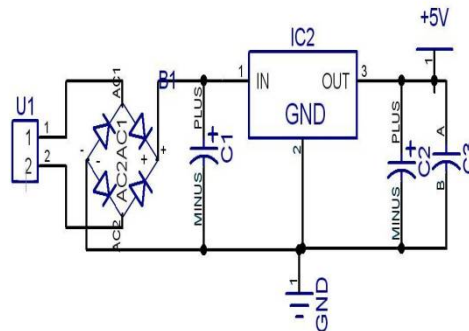
In the power supply unit, rectification is normally achieved using a solid state diode. Diode has the property that will let the electron flow easily in one direction at proper biasing condition . As AC is applied to the diode, electrons only flow when the anode and cathode is negative. Reversing the polarity of voltage will not permit electron flow. During the positive half cycle. The DC voltage appearing across the output terminals of the bridge rectifier will be somewhat less than 90% of the applied rms value. Normally one alteration of the input voltage will reverse the polarities. Opposite ends of the transformer will therefore always be 180 deg out of phase with each other. For a positive cycle, two diodes are connected to the positive voltage at the top winding and only one diode conducts . At the same time one of the other two diodes conducts for the negative voltage that is applied from the bottom winding due to the forward bias for that diode. In this circuit due to positive half cycle D1 & D2 will conduct to give 10.8v pulsating DC. The DC output has a ripple frequency of 100Hz. Since each alteration produces a resulting output pulse, frequency = 2*50 Hz. The output obtained is not a pure DC and therefore filtration has to be done.

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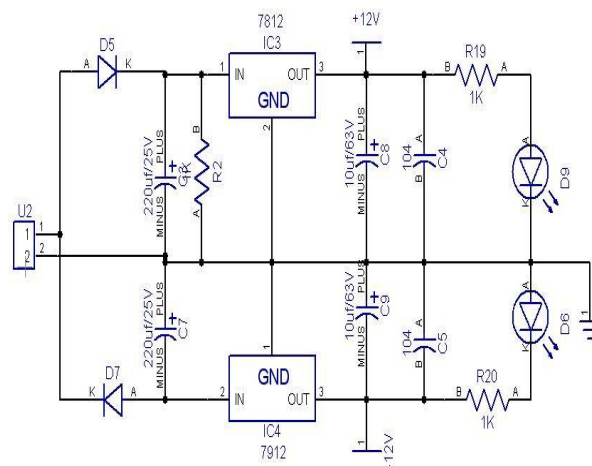


D.FILTERING UNIT

Filter circuits which is usually a capacitor acting as a surge arrester always follow the rectifier unit. This capacitor is also called as a decoupling capacitor or a bypassing capacitor, is used not only to 'short' the ripple with frequency of 120Hz to ground but also to leave the frequency of the DC to appear at the output. A load resistor R1 is connected so that a reference to the ground is maintained. C1R1 is for bypassing ripples. C2R2 is used as a low pass filter, i.e. it passes only low frequency signals and bypasses high frequency signals. The load resistor should be 1% to 2.5% of the load.

E.VOLTAGE REGULATORS

The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device. Power supplies without regulators have an inherent problem of changing DC voltage values due to variations in the load or due to fluctuations in the AC liner voltage. With a regulator connected to the DC output, the voltage can be maintained within a close tolerant region of the desired output.



F.GATE DRIVER CIRCUIT (FAN7392)

The Mosfet's used to switch the capacitor voltage into the supply line there will be switching transients produced by them. These switching transients in turn will affect the pulses developed by the dsPIC30F2010 and by time the micro controller itself. So in order to protect the microcontroller and the control circuit from power circuit we are providing isolation circuit. Once the logical gate signals G1-G4 are available for four MOSFET switches, these have to be isolated before giving to the gate terminals of the switches. An opto-coupler (IC 6N136) is used to provide isolation of logic gate pulse from power circuit. Since there are four switches in VSI, therefore four units of opto-couplers are used.hree

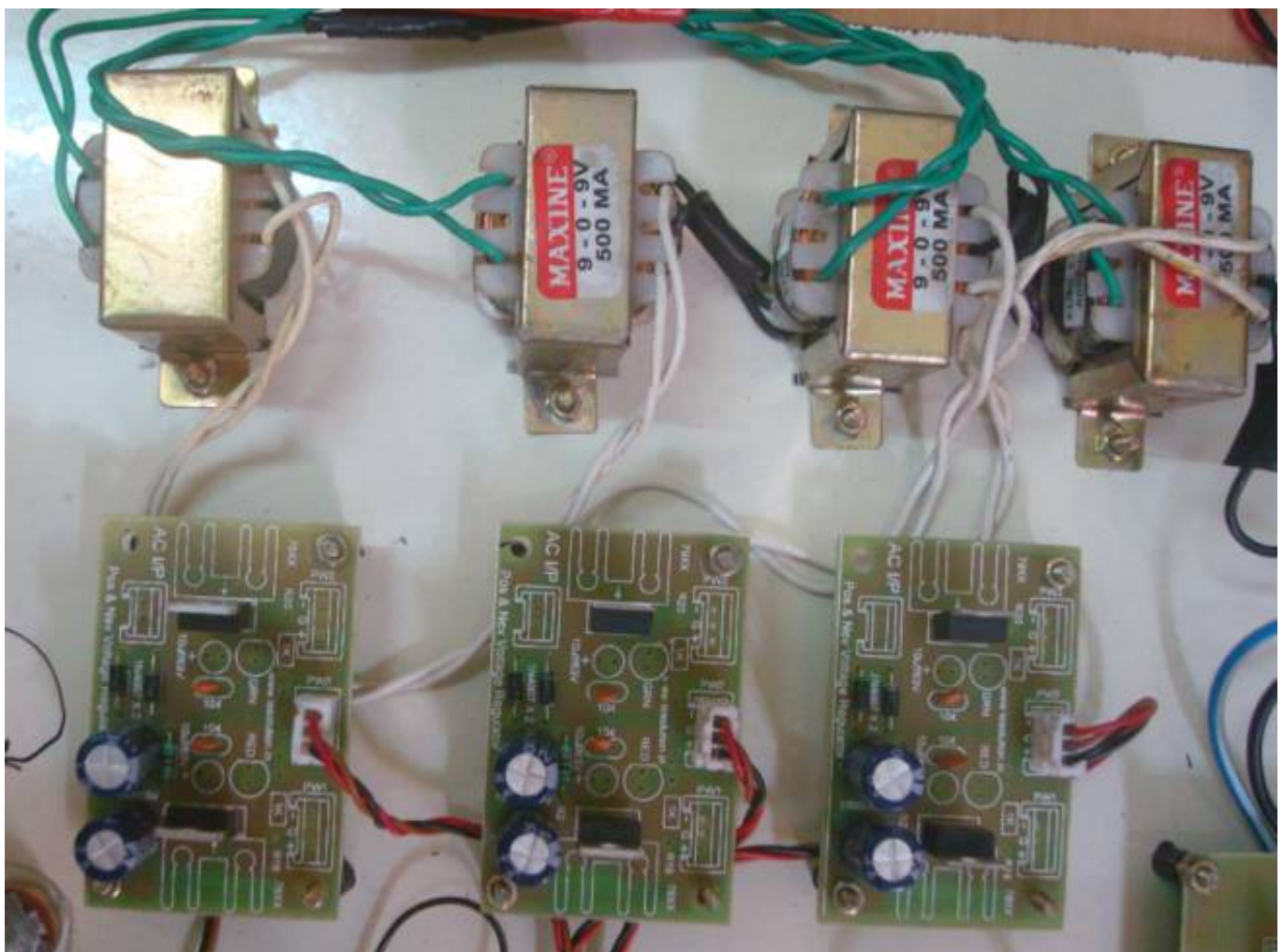
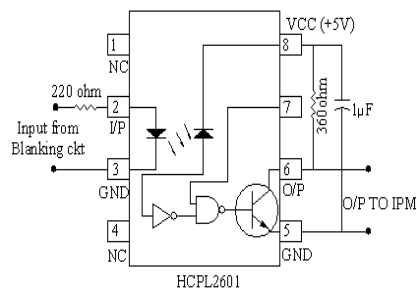
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isolated regulated DC voltage supplies are required. Two isolated DC power supply response of opto-coupler depends on the value of output resistance, this is designed based on the value of supply voltage and current withstand capability of photo transistor in opto-coupler IC



In Fig.3, Hardware snapshot of Hysteresis theory to mitigate sag and swell

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IV. CONCLUSION

The Dynamic Voltage Restorer (DVR) is a promising and effective device for power quality enhancement due to its quick response and high reliability. The conclusion is that the DVR is an effective apparatus to protect sensitive loads from short duration voltage dips. The DVR can be inserted both at the low voltage level and at medium voltage level. The series connection with the existing supply voltages makes it effective at locations where voltage dips are the primary problem. However, the series connection makes the protection equipment more complex as well as the continuous conduction losses and voltage drop. The role of a DVR in mitigating the power quality problems in terms of voltage sag, swell and interruptions is explained. The equations for calculating the voltages and power injected from each of the three DVR phases are given. The results obtained for a single phase dip to zero volts on the red phase are presented to design the PWM Inverter rating of the DVR.

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