iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: XI Month of publication: November 2017

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X1, November 2017- Available at www.ijraset.com

Voltage Sag Compensation by Dynamic Voltage Restorer

R.Harika[1], A.Madhumohan Reddy[2]
[1]M.Tech, Electrical &Electronics Engineering EEE, Malla Reddy Engineering College (MREC), Hyderabad, India
[2]Ast. Professor, Electrical &Electronics Engineering EEE, Malla Reddy Engineering College (MREC), Hyderabad, India

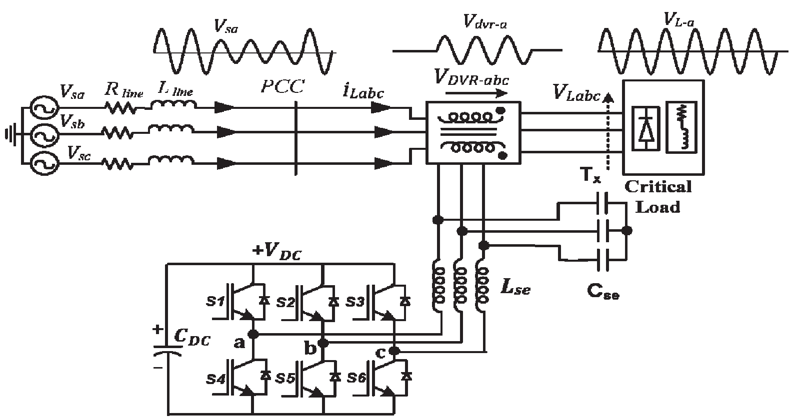
Abstract: This Project deals with improving the voltage equality of sensitive loads from voltage sags using a dynamic voltage restorer (DVR). The higher active power requirement associated with voltage phase jump compensation has caused a substantial rise in size and cost of the dc link energy storage system of DVR. The existing control strategies either mitigate the phase jump or improve the utilization of dc link energy by the following: 1) reducing the amplitude of the injected voltage or 2) optimizing the dc bus energy support. In this paper, an enhanced sag compensation strategy is proposed, which mitigates the phase jump in the load voltage while improving the overall sag compensation time. An analytical study shows that the proposed method significantly increases the DVR sag support time (more than 50%) compared with the existing phase jump compensation methods. This enhancement can also be seen as a considerable reduction in dc link capacitor size for new installation. The performance of the proposed method is evaluated using simulation study and finally verified experimentally on a scaled laboratory prototype.in this project we are using tranisents, filker, swell and induction motor at load side.

Keywords: Dynamic voltage restorer (DVR), voltage phase jump compensation, voltage sag compensation, voltage source inverter (VSI).

I. INTRODUCTION

Industrial distribution systems, the grid voltage disturbances which are imperative for different loads like balanced, unbalanced, linear and nonlinear. It includes lot of phase jumps, sags, swells and etc. The faults and disturbances vary as per the sensitive and protective loads. There are different types of power quality problems like voltage sag, swell, harmonics, transients and etc.

From grid voltage sags, custom power devices to protect sensitive loads (such as dynamic voltage restorer (DVR), SVC, D-STATCOM and UPQC) are used widely. DVR has emerged among these devices, as the comprehensive solution and most cost-effective.



A. Basic DVR-based system configuration

Series injections transformer, LC filters a six-switch voltage source inverter (VSI), and a removing harmonics from the switching of injected voltage. The DVR is to inject voltage as a primary function with certain magnitude and phase connected downstream always sees the pure sinusoidal voltage at its terminals in series with the upstream source voltage such that the load.

The emphasis control strategies numerously for DVR have been reported from the literature. The voltage rating of DVR is on either decreasing by infused voltage adjusting with the source voltage or limiting the dc storage limit (i.e. in-stage compensation) by utilizing the vitality streamlined approach/reactive power pay All however, cannot remedy the phase jump and accordingly can bring about untimely tripping of delicate loads these strategies. The presag strategy requires a lot of active power from the dcconnectcapacitorTheonlypossiblewaytomitigatethephasejumpistorestore the load voltage to the pre fault value. Such an approach is addressed as pre sag compensation in. However, the phase jumps compensation. Thus, this method will require a larger size capacitor or will result in shorter sag support time. In and, an interesting technique is proposed to increase the compensation time while mitigating the voltage phase jump.

A new control strategy in which the main in this project proposes objective is to enhance compensation time in the sag while the voltage phase jumps mitigating. The regulating the contribution of active power to the least possible value is proposed method aims at. It is found that the proposed strategy can bring about over half extra hang bolster time when contrasted and the strategy in and the proposed method is validated the performance of using simulation as well as experimental studies. To avoid the problem of over modulation, in the case of deeper sag depth, an iterative loop is employed in the control block.

B. Dynamic Voltage Restorer (Dvr)

Dynamic voltage restorer was first worked in U.S for the Electric Power Research Institute (EPRI) by Westinghouse. To secure a mechanized yarn assembling and weaving processing plant it was first introduced in 1996 on Duke Power Company matrix framework. DVR is an arrangement associated strong state gadget that is utilized for moderating voltage aggravations in the dispersion framework. It is utilized to control the heap side voltage by infusing voltage into the framework.

It is utilized to repay the heap voltage at an ostensible greatness and stage by remunerating the voltage droop/swell, voltage unbalance and voltage music displayed at the purpose of basic coupling . Its principle work is to quickly support up the heap side voltage in case of an unsettling influence keeping in minds the end goal to stay away from any power interruption to stack.

It is for the most part introduced in a conveyance framework between the supply and the basic load feeder at the purpose of normal coupling (PCC). Fig. 1 demonstrates the area of the DVR. The general setup of DVR comprises of an infusion/supporter transformer, a consonant channel, a Voltage Source Converter (VSC), DC charging circuit and a control and assurance framework.

In most droop rectification methods, the DVR is required to infuse dynamic power into the appropriation line amid the time of remuneration. Consequently, the limit of the vitality stockpiling unit can turn into a constraining element in the aggravation pay process particularly for droops for long term. Voltage droops caused by unsymmetrical line-to line, line to ground, twofold line-to-ground and symmetrical three stage issues are influenced to touchy burdens.

II. INTRODUCTION TO DVR

The reliability and Manufacturing cost have been improved of those solid state devices as new technologies emerged. So, state devices can be purchased at a reasonable price with superior who include protection devices such conventional electrical or pneumatic devices available solid performance than the in the market. Examples for commonly Dynamic Voltage Restorers (DVR) Uninterruptible Power Supplies (UPS) and Active Power Filters (APF) are used custom power devices. To mitigate harmonic problems among those APF whereas UPS and DVR are used to compensate for voltage sag and surge conditions is used occurring due to non-linear loading conditions, from single phase to three phases Voltage sag may occur. Thus, the single and three phases supply industries that use will experience a few intrusions amid their creation procedure and they are constrained to use some type of voltage pay gear But it has been found that voltage sags single phase is routine and most frequent in the power industry.

Employing active voltage injection mode in the DVR minimum with post fault voltage can result in miraculous use of DVR some phase angle shift in the. If voltage active in DVR is less prominent to the load then it can be delivered for maintaining stability. On event of blame which brings about voltage list, As soon as the blame happens the activity of DVR begins? Them ag nitude decrease is joined by stage angle shift and the rest of the voltage extent with respective phase point move is given by the DVR. The initial voltage injection phase angle and magnitude of DVR into different cases considering can be categorized the infusion furthest reaches that will be talked about further. When the list voltage Phasor is accessible, the infusion voltage is controlled to move continuously from the in stage infusion point to the relating least active voltage infusion point. Considering this , a transition process is proposed with the end goal that infusing the voltage distinction between the pre droop and the in hang (source side)
voltages voltage restoration is achieved by during the initial first cycle or so the sag.

The present venture manages just voltage droop, voltages well can be reproduced in same way. The performance of DVR hypothetically istried.Thesimulationofvarious1 stage and 3 stage flaws are done using MATLAB. Application to remunerate the single-phase voltage droops and 3 stage adjusted voltage sags. Therefore this task has contributed a strong knowledge to the innovative work focusing on mechanical The re-enactment comes about demonstrate the very good performance of the controller hypothetically

There are many types of Custom power devices like those listed below:

1) Active Power filters (APF)
2) Battery Energy storage systems (BESS)
3) Distributed Static Compensators (DSTATCOM)
4) Distribution series Capacitors (DSC)
5) Dynamic Voltage Restorer (DVR)
6) Super conducting Magnetic Energy systems (SEMES)
7) Static Electronics Tap Changers (SETC)
8) Solid State Transfer Switches (SSTS)
9) Solid state Fault Current Limiters (SSSFCL)
10) Static VAR Compensators (SVC)
11) Uninterruptible Power Supplies (UPS)
12) Thyristor Switched Capacitors (TSC)

These devices Examples of these devices include motor generator sets (M-G sets) uninterruptible power supplies (UPSs), magnetic synthesisers and super conducting storage work by providing voltage sag ride through capability to critical loads. Devices (SSDs).The adding Power Line Conditioners conventional approach is to the distribution systems as a form of load side solution.

Dynamic Voltage Restorers (DVR) Uninterruptible Power Supplies (UPS), and voltage hang pay facility are the most widely recognized custom power gadgets to compensate for the voltage droops and swells Active Power Filters (APF) with. Whereas DVR and APF are ubiquitous due to the fact are less popular that they are still in the developing stage, are highly efficient and cost effective even though they than UPSs. Due to ongoing development the rapid in the low cost power devices power electronic industry, like APF and DVR will become much popular among the industries in the near future.

APF and DVR are to take out two unique sorts of abnormalities regularly utilized that influence the power quality. They are talked about in light of two diverse

Load The stack is thought to be a straight when both the dependent variable and the free factor show linear changes to each other. The non-straight load on

the other hand does not demonstrate a straight change Example: Resistors.

III. WORKING PRINCIPLE, CONSTRUCTION AND MODES OF DYNAMIC VOLTAGE RESTORER (DVR)

Out of the have been have been proposed various approaches that to limit the cost causes by dynamic voltage restorer , voltage sag (DVR) is one of the best methods to address voltage sag problems. By and large voltage sag can be exceptionally costly and cause serious issues for the clients as it might prompt generation harm and downtime. This technique is quickly examined in our thesis and it can be utilized to redress voltage list at distribution level by using power electronics devices also known as customer power device a certain amount of voltage and power of voltage sag can be minimized can be injected into the distribution system and this severe problem.

For high-tech industries some sensitive loads in voltage sags such as those are highly undesirable. One that determines the quality of power supply of the major factors is the voltage magnitude. It is a testing errand to keep up the heap voltage prerequisites with proper magnitude and amend the voltage list amid voltage disturbances and changes. For different reasons frequent voltage sags are often experienced by loads at distribution level.

A. Principles of DVR Operation

Under normal operating conditions less magnitude provides very device losses. However, when there is voltage sag of voltage to make up for the voltage drop of transformer and which guarantees that heap voltage is uninterrupted and is kept up In this case the capacitor will be discharged to keep the load supply constant. when there is no Voltage sag, DVR in distribution system, voltage of high magnitude and desired phase angle DVR will generate a required controlled.

The DVR is that by means of an injecting transformer basic idea of a control voltage is generated a capacitor bank as energy storage device and injection transformers. From the figure it can be seen that DVR is connected in between the distribution system and the load. A DVR is a solid state control gadgets exchanging gadget which comprises of either GTO or IGBT, A managed DCsource is given by a DC capacitor bank which acts a vitality stockpiling gadget. which is in seriesto the transport voltage by a constrained drove.

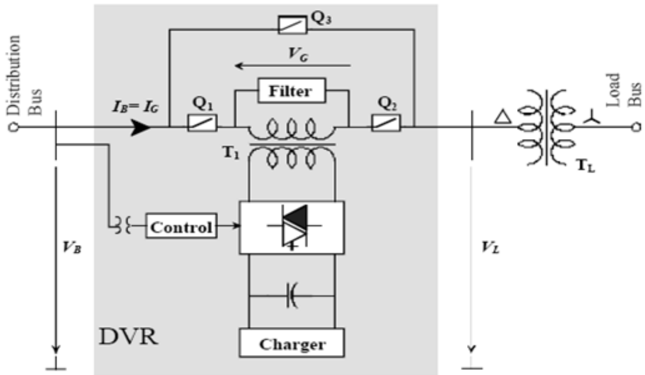


Fig. Principle of DVR with a Response Time of Less than One Millisecond

The normal reaction and which is substantially less than some of the customary strategies for voltage revision, for example, tap changing transformers time is around 25 milliseconds, the response time is restricted by the power gadgets devices and the voltage list discovery time. .of DVD is exceptionally short and Note that the DVR of the gadget must be provided by an outer vitality source or vitality stockpiling framework. fit for creating or retaining reactive power yet the responsive power infusion.

B. Voltage and Current Variations

The two basic examples are voltage magnitude and frequency. On average, voltage magnitude and voltage frequency are equal to their nominal value, but they are never exactly equal Voltage and current variations are relatively small deviations of voltage or current characteristics around their nominal or ideal values.

IV. VOLTAGE MAGNITUDE VARIATION

A. Voltag

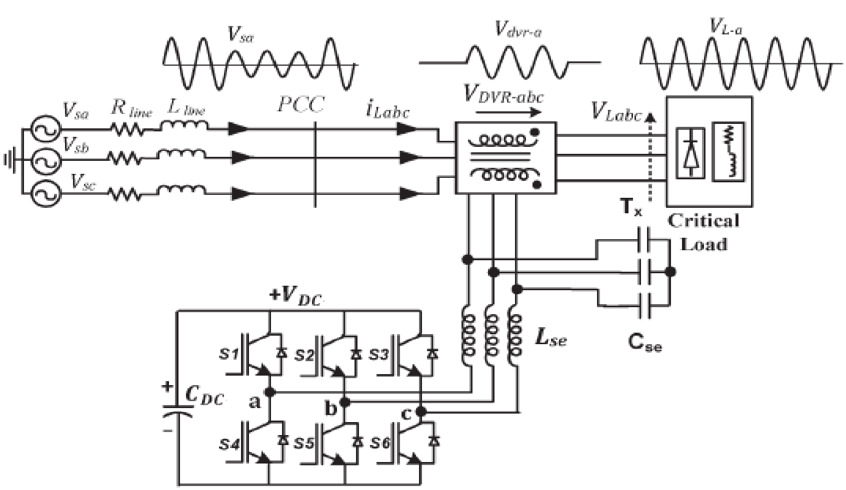
Voltage magnitude variation called the variation in voltage by smaller range is. Increase And decrease of the voltage magnitude.

1) Due to variation of the total load of a distribution system or part of it.
2) Actions of transformer tap-changers.
3) Switching of capacitor banks or reactors.

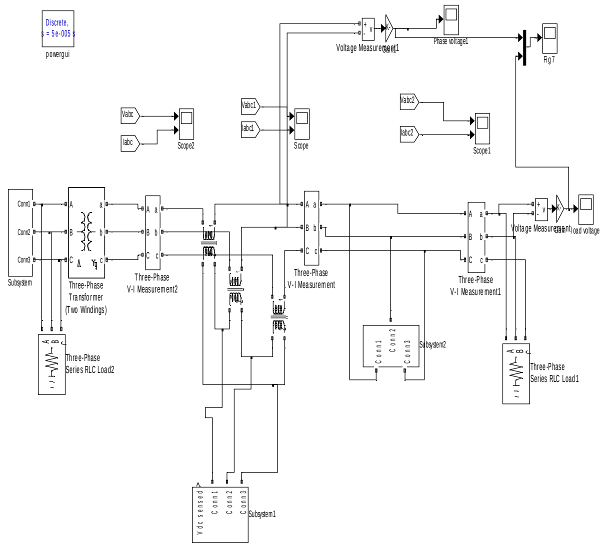
he impact of tap changers. And capacitor banks influences that the everyday to design isn't generally present in the voltage greatness design. In this way the voltage greatness varieties are basically because of load varieties, which take after a day by day design. Transformer tap-changer activities and exchanging of capacitor banks can ordinarily be followed back to stack varieties too.

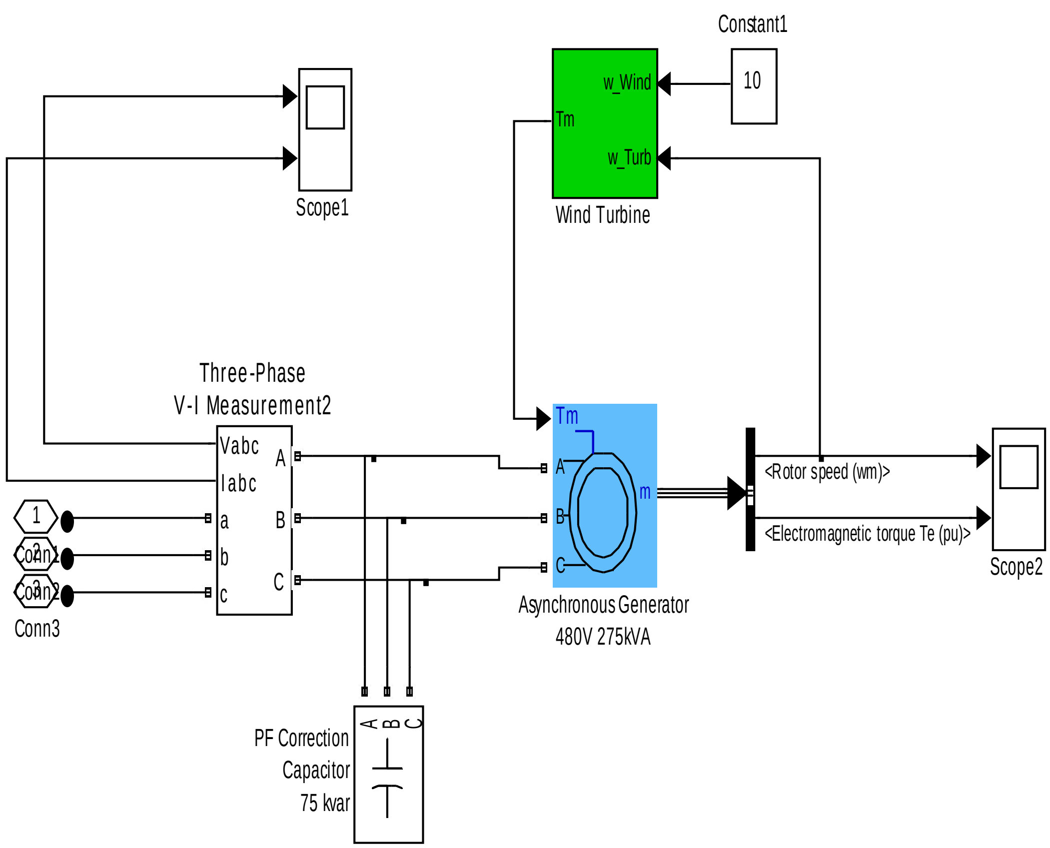
V. SIMUALTION MODELS AND RESULTS

A. DVR With PV Panel



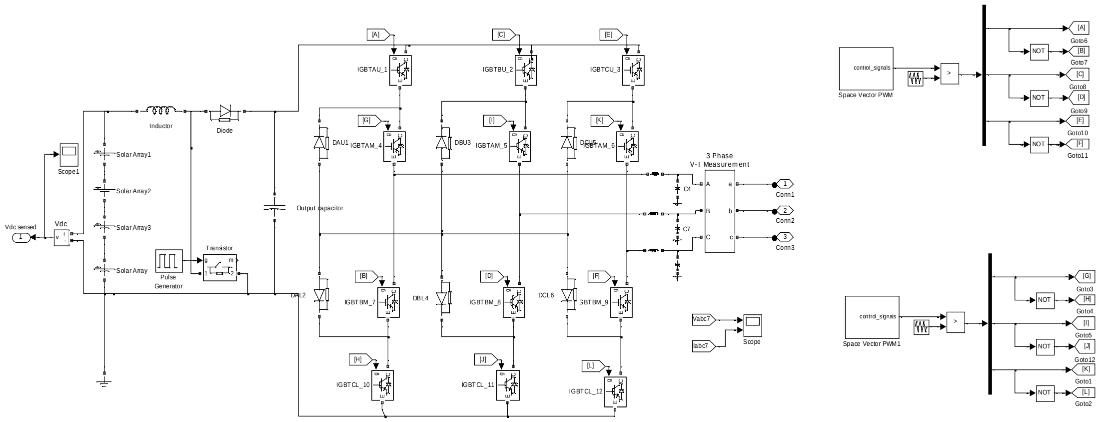
B. DVR with PV panel



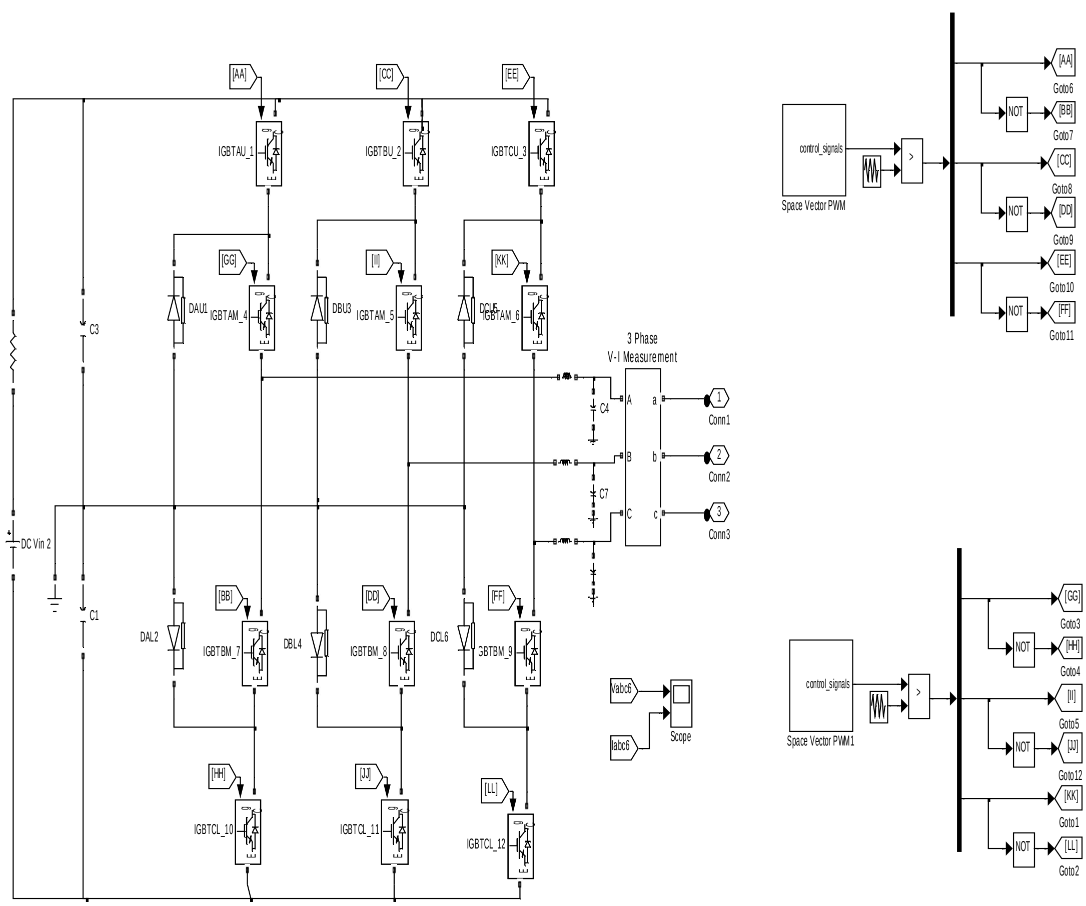


Subsystem of the source1 (From wind turbine)

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X1, November 2017- Available at www.ijraset.com

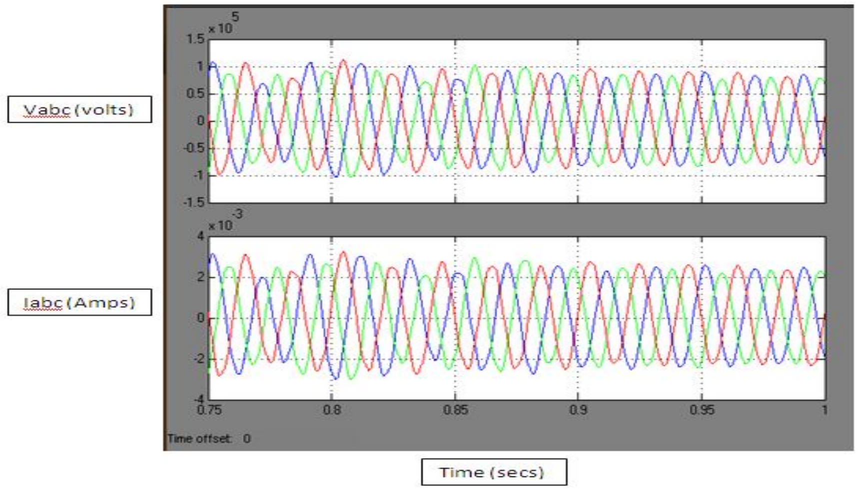


Subsystem of the source2 (From Photovoltaic panel)

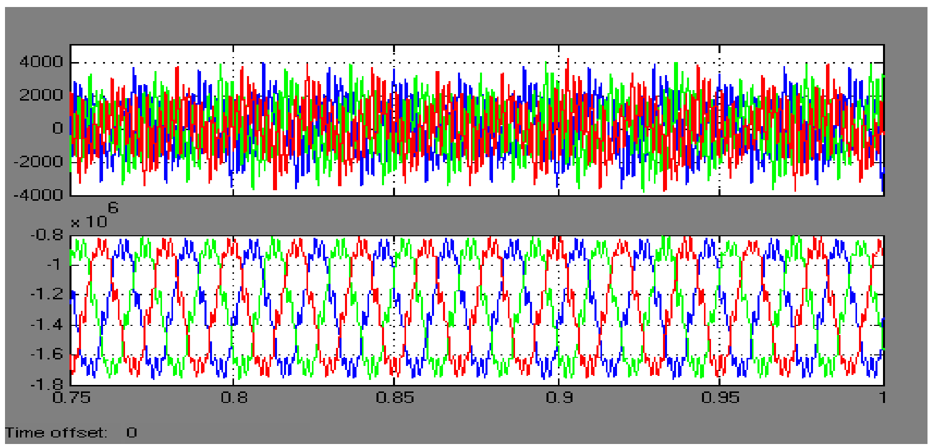


Subsystem of the three-phase inverter

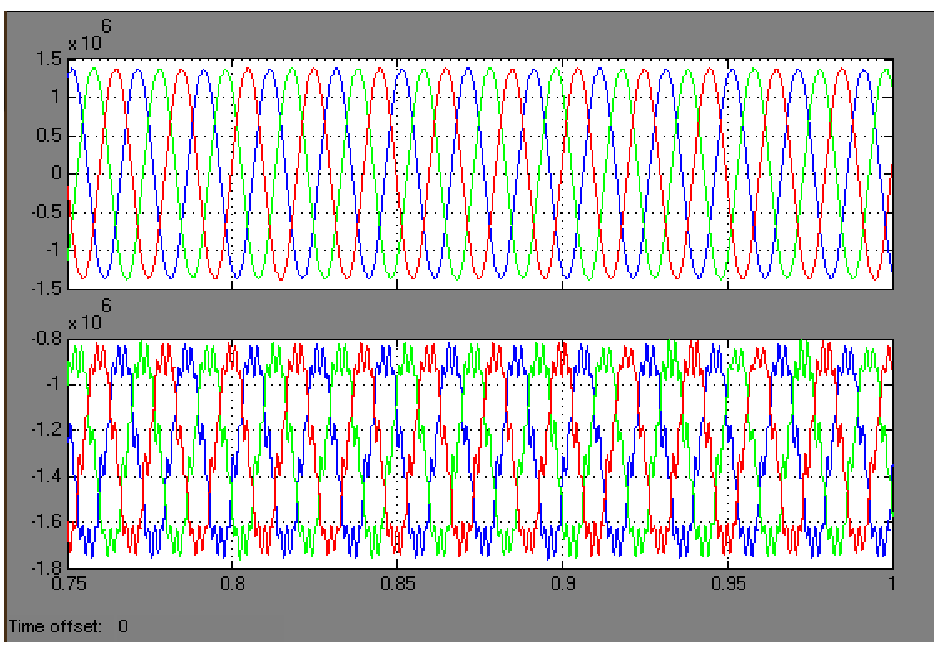
International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X1, November 2017- Available at www.ijraset.com



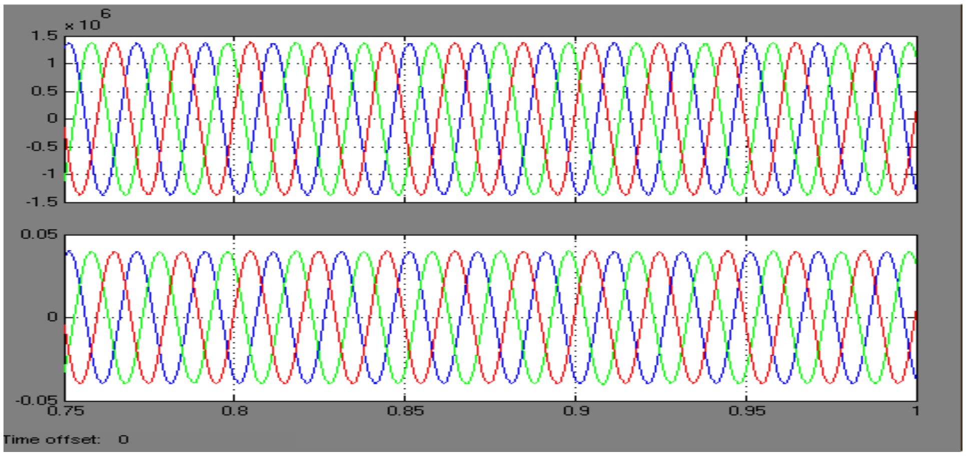
Three-phase voltages and currents distortions Versus Time (sec)



Three-phase source voltages and currents versus time (secs) effected when load applied



Three-phase source voltages and currents versus time (secs) effected when load applied before compensation



Three- phase's source voltages and currents versus time(secs) effected when load applied After compensation

VI. CONCLUSION

The most severe power quality problems are known as voltage sag, swell and harmonics. Series connected custom power device called as dynamic voltage restorer (DVR) is the most effective device used in electrical systems to compensate these power quality problems. Traditional DVR compensates only voltage sag/swell in electrical grids. The main contribution in DVR to compensate unbalanced voltage sag/swell and unbalanced voltage harmonics, simultaneously .The both voltage sag/swell detection and voltage harmonics extraction at the same time. The DVR compensates voltage sag/swell within 5ms while unbalanced selective voltage harmonics (5th, 7th, 11th and 13th) are the performance of proposed controller method is presented and confirmed through simulation results compensated in the system, simultaneously. The system is analyzed for various case studies.

REFERENCE

[1] J. A. Martinez and J.M. Arnedo, "Voltage sag studies in distribution networks—Part I: System modeling," IEEE Trans. Power Del., vol. 21, no. 3, pp. 338–345, Jul. 2006.
[2] J. G. Nielsen, F. Blaabjerg, and N. Mohan, "Control strategies for dynamic Voltage restorer, compensating voltage sags with phase jump," in *Proc.* IEEE APECE xpo., 2001, pp. 1267–1273.
[3] J. D. Li, S. S. Choi, and D. M.Vilathgamuwa, "Impact of voltage phase jumponloadsanditsmitigation,"inProc.4thInt. Power Electron. Motion Control Conf.,Xi'an,China,Aug.14–16,2004,vol.3,pp.1762–1176.
[4] M. Sullivan, T. Vardell, and M. Johnson, "Power interruption costs to industrial and commercial consumers of electricity," IEEE Trans. Ind. Appl., vol. 33, no. 6, pp. 1448–1458, Nov./Dec. 1997.
[5] A.K. Sadighand K .M. Smedley, "Review of voltage compensation methods in dynamic voltage restorer(DVR),"in Proc. IEEE Power Energy Soc. Gen. Meet., Jul. 2012, pp.1–8.
[6] J. G. Nielsen and F. Blaabjerg, "Control strategies for dynamic voltage restorer compensating voltage sags with phase jump," in Proc. IEEE Annu. Appl.Power Electron. Conf. Expo., 2001, no. 2, pp. 1267–1273.
[7] H. K. Al-Hadidi, A. M. Gole, and D. A. Jacobson, "A novel configuration for acascade inverter based dynamic voltage restorer with reduced energy storage requirements," IEEE Trans. Power Del., vol. 23, no. 2, pp. 881– 888, Apr. 2008.
[8] H. K. Al-Hadidi, A. M. Gole, and D. A. Jacobson, "Minimum power operation of cascade inverter-based dynamic voltage restorer," IEEETrans. Power Del., vol. 23, no. 2, pp. 889–898, Apr.2008.
[9] C. Meyer, R. W. Doncker, Y. W. Li, and F. Blaabjerg, "Experimental verification of an optimized control strategy for amedium-voltage DVR," in Proc. 36th IEEEPESC, 2006, pp.1–7.
[10] C. Meyer, R. W. Doncker, Y. W. Li, and F. Blaabjerg, "Optimized control strategy for a medium-voltage DVR—Theoretical investigations and experimentalresults,"IEEETrans.PowerElectron.,vol.23,no.6,pp.2746– 2754, Nov. 2008.
[11] T. M. Undeland, W. P. Robbins, and N. Mohan, Power Electronics Converters, Applications and Design. New York, NY, USA: Wiley, 2003.
[12] C. Fitzer, M. Barnes, and P. Green, "Voltage sag detection technique for a dynamicvoltagerestorer,"IEEETrans.Ind.Appl.,vol.40,no.1,pp.203– 212, Jan./Feb.2004.
[13] T. Jimichi, H. Fujita, and H. Akagi, "Design and experimentation of a dynamic voltage restorer capable of significantly reducing an energy- storage element," IEEE Trans. Ind. Appl., vol. 44, no. 3, pp. 817–825, May/Jun. 2008.
[14] H. Igarashi and H. Akagi, "System configurations and operating performance of a dynamic voltage restorer," IEEJ Trans. Ind. Appl., vol. 123, no. 9, pp. 1021–1028, Sep. 2003.
[15] L.Yong,X.Guochun, L.Bo, W. Xuanlv, and Z. Sihan, "A transformer less active voltage quality regulator with the parasitic boost circuit," IEEE Trans.PowerElectron.,vol.29,no.4,pp.1746–1756,Apr.2014.
[16] A. Prasai and D. M. Divan, "Zero-energy sag correctors—Optimizing dynamic voltage restorers for industrial applications," IEEE Trans. Ind. Appl., vol. 44, no. 6, pp. 1777–1784, Nov./Dec. 2008.