SIMPLIFIED DYNAMIC VOLTAGE RESTORER FOR VOLTAGE SAG AND SWELL PROBLEMS

Govula.Sumanth[1], P. Gopala Krishna.[2]

[1]M.Tech Scholar (PS), [2] Asst. Professor Deptt of EEE

Nalanda Institute of Engg and Tech. (NIET), Siddharth Nagar, Guntur, A.P. (India)

ABSTRACT

In the distribution systems to protect consumers from the sudden variations in the voltage magnitudes based on the presence of voltage sags and swells are main issues in distributions these types of problems are compensated by placing the dynamic voltage restorer (DVR) in the distribution side. In this paper we are implemented the multi functional dynamic voltage control strategy with the posicast and P+ controllers are implemented to enhance the transient response and overcome the steady state errors in the DVR response. In this paper we can control the different problems such as voltage sags and voltage swells also we can compensate the induction motor starting torque problems and three fault conditions with under downstream fault conditions also explained. The current condition is restore the point of common coupling arrangement is provided the voltage and protects the DVR itself to identify the problems and compensate those problems very effective manner. The corresponding simulation results are discussed in the MATLAB/ SIMULINK.

Index Terms: Dynamic Voltage Restorer (DVR), Power System, PCC, Posicast and P+ Controllers, Closed Loop Arrangement, Voltage Sag and Swell Problems.

I. INTRODUCTION

Advanced power systems are very difficult networks, there is hundreds of generating power plants are producing and thousands of load corresponding requirements are consistent throughout long power transmission lines and distribution network arrangements.

The main apprehension of customers is the power quality and performance of power supply side at different load conditions where they are positioned. Although power production is the majority of the residential countries side is moderately dependable, the superiority of the source side is not so effective.

In the Power system distribution arrangements, if promising ought to make available their consumers with a continuous flow of power at purified Alternating sinusoidal voltage at the constricted amplitude level and operated frequency.

Conversely in observation, power systems are presented, mainly the distribution topologies have frequent nonlinear load conditions, which considerably influence the affect the power quality in the power supply. As a consequence of the nonlinear operating load conditions, the purity of the waveform characteristics of supply is vanished.

These trimmings up developing much high power quality concerns are presented. Separately from nonlinear load conditions some system parameters working conditions; both capacitor switching arrangement conditions, motor starting methods and abnormal faults might be inflict power quality problems in the power system.

The power quality difficulty is definite as any important trouble in voltage/current principal to occurrence of frequency fluctuations that outcomes in malfunction or miss-operation of consumer requirement.

According to the electrical detachment associated to impedance, the category of grounding arrangement of transformers flanked by the faulted/ load conditions and the node point, there can be a momentary loss in voltage or provisional voltage diminution (sag) or voltage augment(swell) at diverse node conditions of the system.

Along with the numerous novel tradition power components, the Dynamic Voltage Restorer is the most precisely superior and cost-effective device for voltage sag and voltage swell identification and compensation in distribution belongings. The DVR functioned by injecting the additional required AC voltages in series with the receiving side three phase network arrangements, the principle of which is to get better the power quality by an modification in the voltage amplitude value, wave shape configuration and phase shift specifications in the power systems.

The voltage sag reimbursement operates and performs the injection of required real and reactive power in to the distribution side. The reactive power constraint can be developed automatically inside the voltage source inverter (VSC) of the DVR.

Compresses the steady state error and transient response conditions due to the insertion of posicast controller. In this paper the DVR system performed like virtual impedance operation.

This organization can be utilized to defend a group of customers when the reason of annoyance is in the DVR's feeder and the great fault current permits from side to side the DVR itself. The apparatus can control the fault current and defend the loads in parallel feeder technologies until the breaker performed and triggered off by the faulted feeder.

In this classification, the DVR functioned like a purified virtual inductance control strategy which does not having any real power requirements from the external system arrangements and, consequently, compensates the dc-link capacitor voltage and battery. There might be some problems when fascination of real power is finished. This may be destructive to the battery life time and dc-link capacitor arrangements. Therefore impedance consisting of an resistance and an inductance included and those are attached in parallel with respect to the dc-link capacitor location. This strength be compensate the arrangement. It overcomes the Steady State error values and it overcomes the Point of Common Coupling Voltage throughout the downstream. Fault conditions in the IT.

II. PERFORMANCE OF DVR SYSTEM

The power quality issues such as (sags, swells, distortions etc.) can be conquering by utilizing the perception of tradition power electronic devices which is suggested earlier. One of those residential strategies Dynamic Voltage Restorer (DVR) is the very efficient and successful contemporary custom power electronic device operated under power distribution systems.

The position of DVR is as illustrated in the Fig.1. DVR is an advanced controlled device which is connected in series and that solid state device produces the injection of additional required load voltage into the classification in order to normalize the load side voltage requirement.

It is generally performed in a distribution networks between the source side and the dangerous load feeder conditions at the point of common coupling (PCC) designing. Additional problems like voltage sags and swells

compensation, DVR be competent to be also functioned in additional corresponding features like: line voltage distortions mitigation, decrease in transients like as voltage conditions and fault current restrictions.

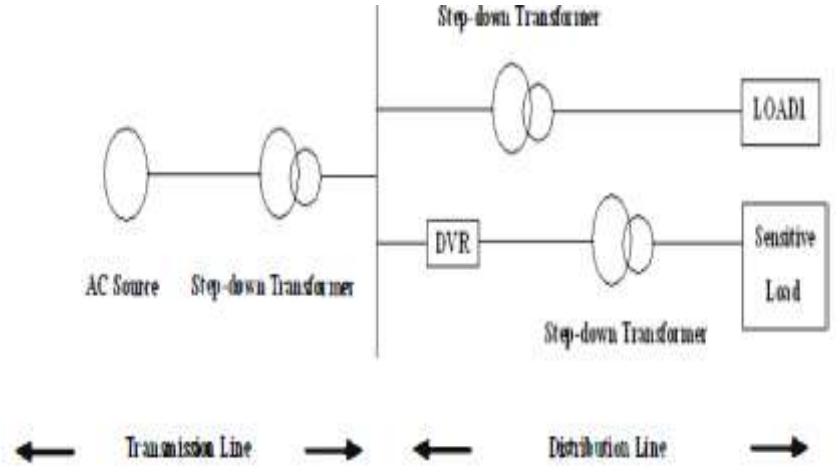

Fig.1 Location of DVR

Now a day the fault presented the accomplishment of DVR starts. On incident of fault with in the presence of voltage sag, the amplitude declinement is considered by phase angle and the phase shift arrangements and the outstanding voltage extents with particular phase angle transfer is presented by the DVR. Applying slightest active voltage contents injection methodology in the DVR with several phase angle alignments in the post responsibility voltage can effect in astounding use of DVR. If vigorous voltage is less important in DVR then it can be generates to the load for regulating stability condition.

Considering the conversion development is implemented such that voltage reinstatement is generated by projecting the additional required load voltage dissimilarity connecting the pre sag positions and the in sag modulations (source side) voltages throughout the preliminary first operating cycle or consequently the sag. When the sag corresponding voltage phasor is accessible, the additional voltage is modulated to move increasingly from the in phase requirement of the point to the equivalent smallest active voltage insertion point considerations.

2.1 Configuration of Dvr

The designed diagram of a conservative DVR integrated into a distribution network arrangement is demonstrated in fIg.2.

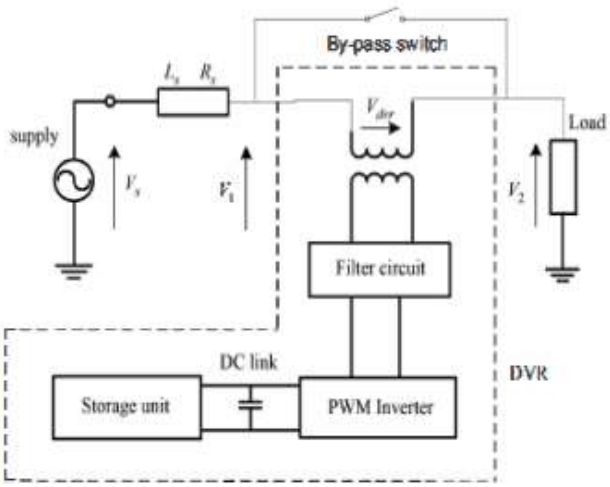

Fig.2. Representation of DVR System Injection! Booster Transformer

The inoculation / Booster transformer is a particularly calculated transformer to facilitate the required operation to control the coupling of noise and transient response in the primary side of the to the secondary side of the transformer.

Its mainly associated with the DVR to the distribution process via the HV –tapings and performs and modifies the additional required protecting voltages production by the voltage source converters (VSC) to the receiving side source side voltage.

In accumulation, the Boost transformer performs the function of isolating materials with the load from the circuitry. The MVA ratings are resolute by utilizing power measurement equation by allowing for safety periphery represented as Ks. V pris the primary side operated voltage of the boost transformer and Ipris the corresponding current value of boost transformer.

P=$K_s V_{pr} I_{pr}$

V_{inj}=DV_r

V_S=$(1-D)V_r$

The causes of voltage sags are normally lighting attacks or short circuit conditions. The problems can cause the amplitude and phase shift of the source side voltage The most widespread issue is distortions are power electronic components in load side and switch mode condition power quantity levels. Owing to the incredible recompense in competence and modulating technology, power electronic system based loads are performed and can be establish at various king of power levels.

Harmonic currents produce distortional voltages as they surpass from side to side the organization impedance. These distortional content based components can affect input voltage fluctuations, extra heating applications, over voltages generations in distribution and transmission technologies, errors in commitments and the breakdown of suspicious relays. DVR utilized the major parameters like as diodes, power equipments like as transistors and other devices for controlling required load voltage, maintain the power flow complexities, conversion of DC voltage to Alternating current voltage and defensive itself from problems. During the procedure, the PWM inverter generates disturbances. These disturbances ought to be concentrated to a satisfactory boundary causing insignificant impact to the load and effectiveness supply. In order to regulate or overcome this distortions there is some filters are utilized in the power system based applications.

THD=$\frac{\sqrt{\sum_2^\infty C_K^2}}{C_1}$*100%

C_1, is the amplitude of the minimum operated fundamental component; Ck represents the amplitude of the disturbance mechanism (k= 2, 3, 4 ...). The voltage equivalent THD value ought to be lower than 5% for susceptible sensitive load conditions.

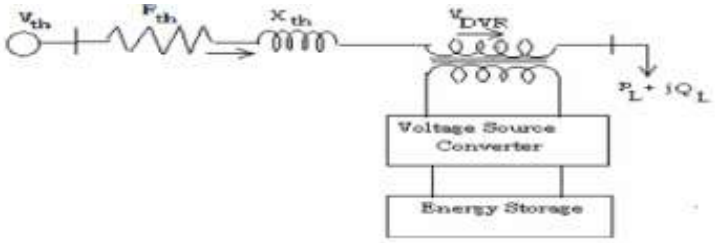

Fig.3. Equivalent Circuit Diagram of DVR

The LC filters are connected and be utilized for harmonic mitigation if the generations of distortions have steady state frequency excluding the passive filters be able to generate less frequency resonant applications with the

power system arrangement. The usage of active filters can mitigate the harmonics of dissimilar frequencies are produced even if the fluctuations are not continuous. Conversely, high operating frequency is essential for the active filters development. The correspondent block diagram of Dynamic Voltage Restorer is as demonstrated in the Fig.3.

The network impedance Zth based on the fault level considerations of the load bus. When the network operating voltage (□h) drops produced, the DVR injects the additional required voltage a series voltage considerations Vdvr from side to side the injection voltage transformer consequently that the preferred load voltage amplitude VL can be modulated. The succession additional voltage of the DVR can be given as

$$V_{dvr}+V_{th}=V_L+Z_{th}I_L$$

$$V_{dvr}=V_L+Z_{th}I_L-V_{th}$$

$$Z_{th}=R_{th}+jX_{th}$$

$$I_L=\frac{P_L-jQ_L}{V_L}$$

2.2 The Analytical Model of Posicast Controller

The Block diagram representations explanation of the half-cycle developments Posicast regulator is revealed in Fig.4. The representation has two advance paths. The upper lane is that of the resourceful, uncontrolled command involvement. In the command is primarily subtracted, subsequently that the crest of the reaction will not exceed the preferred final value of the system.

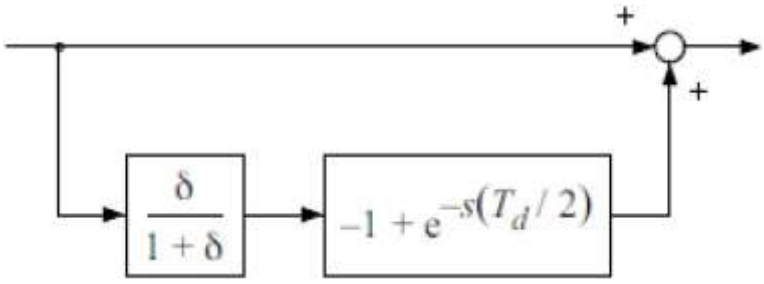

Fig.4. Transfer Function Form

The open loop control strategy arrangement is developed by using the Posicast regulator is illustrated in the figure 5.

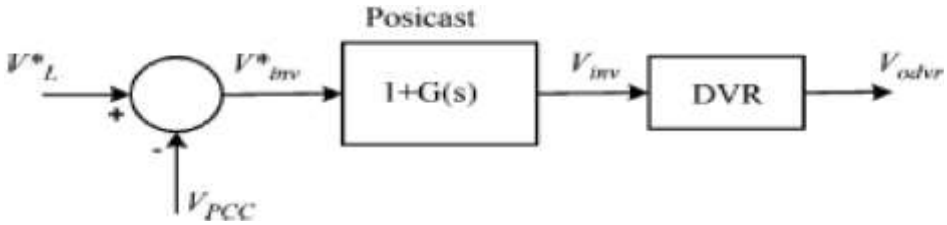

Fig.5. Open Loop Control Using the Posicast Controller

The source voltages are replaced by V L and V pee instead of V I and V 2. In this mentioned fig.5, the voltage on the supply side of the DVR arrangement. So that the required additional extra voltage Vinv * is calculated. To get better damping response, as demonstrated in Fig.5 .The Posicast compensator can be utilized just before sending the voltages the signal must to connect PWM inverter of the DVR.

This is then specified to the Posicast director. It has high-frequency corresponding gain and therefore low sensitivity noise is generated. To eradicate the steady-state error voltage identifying the error, a correspondingly

less concentrated P+Resonant controller is supplementary to the external voltage loop. The perfect P+Resonant controller can be accurately expressed as

$$G_R(S) = K_{P+}\frac{2K_1S}{S^2+\omega^2}$$

In designed circuit utilizes closed loop control arrangement of the system. At this time the route performed of the three phase converter in source side which generates a voltage up to the range of 240 rms phase-to-phase voltage specifications selected. The use of two transformers to pick up the voltage levels in the transmission line absent conditions which initial one by using the step down transformer device we can convert the voltages (240V/240e3V) and the second transformer increases up the voltage levels.

The DVR arrangement is associated to the transmission line network with the boost transformer technique. The gate pulses are produced by developing the PWM to the inverter are get from the PIC controllers in the circuit designing conditions whereas at this time in the duplicate the conducting pulses is got from the error signal generated by checking the values of Vref and Vpcc voltage levels also utilized the specialized PWM technique to give the pulses to the inverter with effective manner.

This voltage is then additional required voltage level by the boost transformer to the transmission line requirements. When the load is associated and incoherent there presented some problems like as sag and swells in the networks.

III. CONCLUSION

In the distribution System facing the problems like voltage sags and swells can reduces the efficiency of the distribution network arrangements. To recognize the troubles and compensating these problems purpose an effective Dynamic voltage controller is implemented to improve the performance of the distribution systems.

In this system we are proposed the DVR acts as a multi functional device and also used Posicast and P+ controllers are used to enhance the power quality of the distribution networks. By providing these controllers the transient response is improved and the steady state errors are overcome by these controllers.

In this these system different type of problems are compensated by the presence of DVR and hence the system performance is enhanced then the reliability of the system is improved. The simulated results are discussed the MATLAB/ SIMULINK are Explained in this suggested paper.

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AUTHOR DETAILS

	**Govula Sumanth**, Pursuing M.tech (PS) Nalanda institute of Engineering and Technology(NIET), Siddharth Nagar, Kantepudi village, satenepalli Mandal, Guntur Dist.,A.P, India
	**P.Gopala krishna**, working as Asst.professor (EEE) at Nalanda institute of Engineering and Technology (NIET), Siddharth Nagar, Kantepudi village,satenepalli Mandal, Guntur Dist.,A.P, India