



IMPLEMENTING THE POWER QUALITY IN DISTRIBUTION NETWORKS BY USING DSTATCOM UNDER VARIOUS FAULT CONDITION

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ABSTRACT:

Presently a day's Improvement of Power quality has turned into a noteworthy zone of worry in electrical force framework. Expanded touchy and modern burdens results nonstandard voltage, current and recurrence and diminish nature of force. This nonstandard force results disappointment of the heaps associated with the circulation frameworks. In this manner it has been essential to enhance the nature of force which is exceptionally extreme for the mechanical clients as it can bring about breaking down of a few delicate electronic types of gear. Voltage quality is the significant issue which is exceptionally serious for the delicate electronic types of gear. This paper portrays voltage quality change by utilizing Dynamic Voltage Restorer (DVR) and Distribution Static Synchronous Compensator . DVR or D-ST is a custom force gadget (CPD), which is associated in arrangement or in shunt with the system to keep up level voltage profile in electrical dispersion framework. This paper presents demonstrating and recreation of DVR and D-ST in MATLAB SIMULINK. Exchanging or activating signs for the exchanging gadgets are given by PI controller and discrete PWM generator which are utilized to control the yield of DVR and DSTATCOM. Reenactment result demonstrates the execution of DVR and D-ST under different blames, for example, single line to ground shortcoming (LG), twofold line to ground deficiency (LLG), three stage to ground issue and so on. The reproduction result demonstrates DVR is more proficient than D-ST for force quality change.

Keywords: Custom Power Device (CPD), Distribution Static Synchronous Compensator , Power quality, Pulse Width Modulator(PWM).

1. INTRODUCTION:

Electrical vitality is the most helpful type of vitality as it can be changed over into different types of vitality for various purposes as lighting, warming, cooling and for number of uses. Along these lines the utilization of power is expanding step by step all through the world. As the utilization of power increments there will be a genuine lack of force. The deficiency might be because of the expansion in the utilization or because of the breaking down of the gear in the framework. A definitive approach to diminish or conquer these deficiencies is to expand the force era hugely or to beat the circumstances of breaking down. This paper shows an answer for beat the later circumstance. To beat these issues suitable measures are taken some time recently, similar to circuit breakers, isolators and so on, while taking these wellbeing measures there might be states of exchanging on additional gear or exchanging off of the present hardware. Because of this marvel there might be a decrease of receptive power or increment of responsive force in the framework which prompts the dynamic force change. There might be a sudden change in the heap which for moment lessens or expands the dynamic force which thus prompts the voltage change and misshaped waveforms. On the off chance that any short out or open circuit in the line or stage happens, the voltage esteem changes in the line[1]. These issues which are identified with issues happening in the framework exasperating the solidness are called as force quality issues. In the event that these issues are not disposed of by utilizing a suitable control method, the whole framework might lose its strength. By keeping the need of force prerequisite in everyday life these days there is a need to concentrate on force quality issues to unravel

the financial difficulties with the force framework all through the world. The term power quality portrays by the size and waveforms of the voltage and current in force framework, for standard force quality means voltage ought to be inside of the breaking point and waveform ought not be misshaped.

1.1 Power Quality

The thought of force quality issues is a critical variable to meet the shopper's requests. On the other side ,for the electrical supply commercial ventures, the nature of force conveyed is one of the recognizing element for guaranteeing client dependability in this present focused and deregulated business sector .To address the necessities of vitality shoppers attempting to enhance efficiency through the lessening of force quality related procedure stoppages and vitality suppliers attempting to augment working benefits while keeping clients fulfilled by supply quality, imaginative innovations giving the way to financially savvy power quality improvements arrangements. Different force quality arrangements are accessible; the inquiry for a shopper or utility confronting a specific force quality issue is which gear giving the better arrangement implies lesser sounds [1].

1.2 An Introduction to Power System Harmonics

Essentially the primary goal of the electric utility is to convey sinusoidal voltage at genuinely consistent size all through their framework end [2]. At that point this goal is confused by the way that there are number of non direct loads on the framework that delivering symphonious streams in the framework. These symphonious streams result in misshaped voltages and ebbs and flows that can antagonistically affect the framework execution in various ways.

1.3 Effects of Harmonics

•The basically voltage and current harmonics effects throughout the power system are:

- The possibility to amplify of harmonic levels resulting from series and parallel resonances.
- The reduction in efficiency of the generation, transmission and utilization of electric energy.
- Insulation ageing of electrical plant components with consequent shortening of their useful life.
- In Malfunctioning system or components of the plant.

2. THE DSTATCOM SYSTEM CONFIGURATION AND MODELLING

DSTATCOM [1] is a voltage source converter (VSC) that is associated in shunt with the appropriation framework by method for an attach reactance associated with repay the heap current. When all is said in done, a coupling transformer is introduced between the appropriation framework and the DSTATCOM for segregating the DSTATCOM from the dispersion framework. What's more, the gadget should be introduced as near the touchy burden as could be expected under the circumstances to amplify the remunerating capacity. Being a shunt associated gadget, the DSTATCOM principally infuses receptive energy to the framework. The part of DSTATCOM is particularly refreshing if there should arise an occurrence of a frail AC framework [2]. On the off chance that, no vitality source is associated with the DC transport, then the normal force traded by the DSTATCOM is zero expecting the switches, reactors, and capacitors to be perfect.

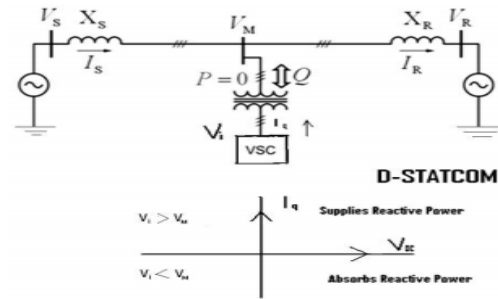


Figure 1. Structure and operating modes of DSTATCOM.

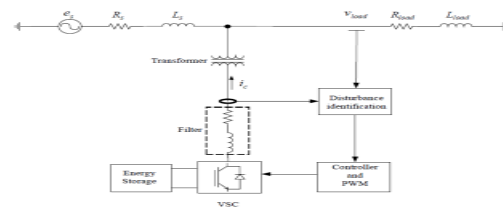


Figure 2. System scheme of DSTATCOM.

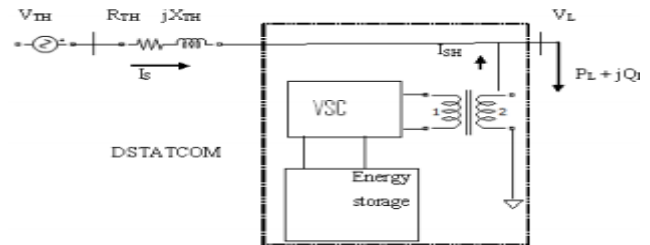


Figure 3. Schematic diagram of DSTATCOM

The adequacy of the DSTATCOM in rectifying the flaw relies on upon the estimation of Z_{th} or issue level of the heap transport. At the point when the shunt supplied current I_{sh} is set in quadrature with V_L , the sought amendment of voltage can be accomplished without infusing any dynamic force into the framework. Then again, when the estimation of I_{sh} is diminished, the same adjustment of voltage can be accomplished with least evident force infusion into the framework. The commitment of the DSTATCOM to the heap transport voltage breaks even with the infused current times the impedance

seen from the gadget likewise, that is the source impedance in parallel with the heap impedance. The capacity of the DSTATCOM to repay the voltage plunge is restricted by this accessible parallel impedance. It lessens the voltage changes at the PCC (purpose of regular coupling) [5],[6]. Voltage plunges can be alleviated by DSTATCOM, which depends on a shunt associated voltage source converter. VSC with heartbeat width tweak (PWM) offers quick and solid control for voltage plunges relief. The topology of the DSTATCOM associated at dissemination level is appeared in Figure 4.

In the proposed model, the use of DSTATCOM to enhance the force quality in a dispersion system with Single Line to Ground (SLG) blame and Double Phase to Ground (DPG) flaw and three-stage deficiency is examined.

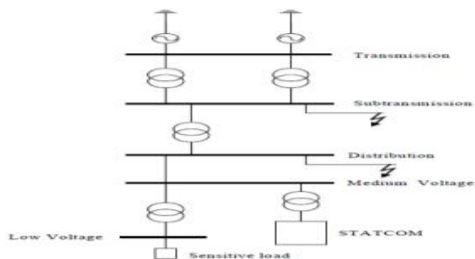


Figure 4. Topology of the power system with DSTATCOM.

3. BASIC PRINCIPLE OF DSTATCOM

A DSTATCOM is a controlled responsive source, which incorporates a voltage source converter (VSC) and a DC join capacitor associated in shunt, fit for creating and/or retaining receptive force. The working standards of DSTATCOM depend on the precise proportionality of the routine turning synchronous compensator. The AC terminals of the VSC are not associated with the purpose of normal

coupling(PCC) through an inductance, which could be a channel inductance or spillage inductance of the coupling transformer , as appeared in figure1.

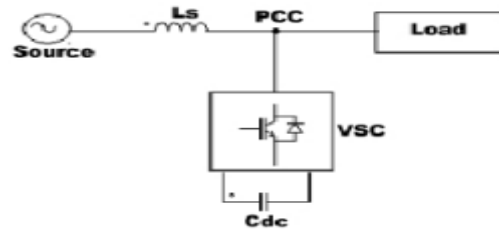


Figure 5: Basic Structure of Dstatcom

The DC side of the converter is associated with a DC capacitor, which conveys the info swell current of the converter and is the principle responsive capacity component. This capacitor could be charged by a battery source, or could be precharged by the converter itself. On the off chance that the yield voltage of the VSC is equivalent to the AC terminal voltage, no receptive force is conveyed to the framework. On the off chance that the yield voltage is more noteworthy than the AC terminal voltage, the DSTATCOM is in the capacitive method of operation and the other way around. The amount of the receptive force stream is relative to the distinction in the two voltages. The voltage regulation at PCC and force component remedy can't be accomplished at the same time. For a DSTATCOM utilized for voltage regulation at the PCC, the remuneration ought to be such that the supply current ought to lead the supply voltages; while, for force element revision, the supply current ought to be in stage with the supply voltages. The stage shift control are utilized to examine the execution of a DSTATCOM for force component remedy and consonant moderation.

4. REGULATION OF AC BUS AND DC LINK VOLTAGE

Three stage AC supply voltages and DC link voltage are detected and nourished to two PI controllers, the yields of which choose the abundance of responsive and dynamic current to be produced by the DSTATCOM[5]. Figure3 demonstrates the piece chart of AC/DC link voltage plan. Augmentation of these amplitudes with the in stage and quadrature voltage unit vectors yields the separate segment of the reference streams. While applying the calculation for force variable rectification and consonant disposal, the quadrature segment of the reference current is made zero. These reference streams and the detected line ebbs and flows are encouraged to a hysteresis controller, which is utilized for following control. This hysteresis controller, includes a hysteresis band $\pm h$ around the ascertained reference current.

The switching is obtained as given below:

If $i_{sa} > (i_{sa_ref} + h)$, the upper switch of inverter leg corresponding to phase 'a' is ON and the lower switch is OFF.

PARAMETERS	EFFECT ON PHASE SHIFT CONTROL
Reactive power compensation	Partial
Performance under balanced and nonlinear loads	Contains undesired harmonics in case of nonlinear load
Applicable for single phase systems	Yes
Harmonic compensation capability	Well above 5% (no harmonics compensation)
PWM switching frequency	Fixed
Self supporting DC bus	No
Generation of firing pulses	Sine PWM

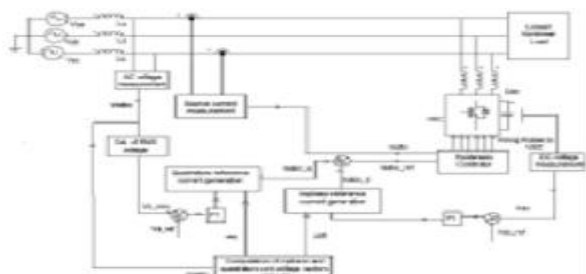


Figure 6: Block diagram using regulation of AC/DC link voltage scheme

The following turns out to be better if the hysteresis band is smaller, yet the exchanging recurrence is expanded, which brings about expanded exchanging misfortunes. Thusly, the decision of hysteresis band ought to be a trade off between following mistake and inverter misfortunes [4]. This strategy for following current control is straightforward and vigorous and it shows a programmed current restricting trademark. This remuneration plan is multi-practical and can likewise be viably utilized for burden unbalancing and symphonious concealment, notwithstanding control variable amendment and element voltage regulation. The transient period is short and finish responsive force pay and power variable amendment is accomplished if there should arise an occurrence of both direct/nonlinear burden, the THD of the source current is 2.01%, well underneath the IEEE-519 standard for consonant concealment.

The upsides of this plan are:

- The inference of exchanging signs utilizes a hysteresis controller, which is vigorous and straightforward, with quick element reaction and programmed current constraining ability.
- The calculation is adaptable and can without much of a stretch adjusted for enhanced voltage regulation, consonant concealment and burden adjusting.
- The natural property to give self-supporting DC transport does not requires complex abc_qdo changes.

- The THD if there should arise an occurrence of nonlinear burden is well beneath the IEEE 519 standard cutoff points.

5. OPERATION OF DVR AND D-STATCOM

Among the force quality issues like droop, swell, consonant, homeless people and so on, voltage list is the most extreme unsettling influence in the force circulation framework, by and large brought about by flaws. It keep going for length of time going from 3 cycles to 30 cycles [6]. Beginning of extensive prompting engines can likewise bring about voltage droop as it draws a lot of current amid beginning which will influence different supplies associated with the framework. With a specific end goal to alleviate voltage droop or swell in dissemination framework DVR and DSTATCOM is utilized. DVR and DSTATCOM is associated in arrangement and in shunt with the line, infuses or retains responsive force keeping in mind the end goal to repay the voltage droop or swell in the circulation line and The equivalent circuit diagram of DVR and DSTATCOM is shown in Fig.4 and Fig 5.

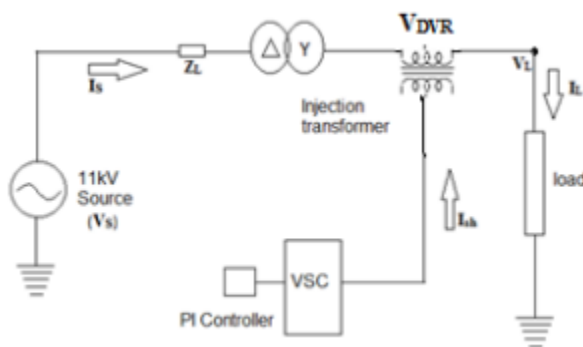


Figure.7 Overall diagram of DVR test model

6. CONCLUSION

In this work, the examination on the part of DSTATCOM is done to enhance the force quality in circulation systems with static direct and non straight loads. Relative Integral (PI) controller is utilized with the gadget to enhance its execution. Test framework is broke down and results are introduced in the reenactment area. The outcomes demonstrates the acceptable execution of DSTATCOM in the dispersion systems under various issue conditions and it can be presumed that DSTATCOM viably enhances the force quality in circulation systems with static straight.

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