ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Improvement of Voltage Stability Using Dynamic Voltage Restorer Using Fuzzy Logic Controller

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Abstract:
As a dynamic voltage restorer energy capacity reduction and optimization of the power system and the proposed work is to evaluate the problem was discovered. The growing interest in the energy and power quality disturbances, leading to a variety of devices designed for reducing the voltage sags. Among the many devices, a dynamic voltage restorer (DVR), a novel custom device power supply system has been proposed to compensate for voltage disturbances. A DVR is the ability to pay the maximum voltage injection and storage capacity will depend on the amount of energy available for restorer. DVR PI controller is used as a voltage source converter control circuit. Simulations MATLAB / Simulink environment is carried out.

I. INTRODUCTION:

Voltage sag and swell voltage distribution system that encompass nearly 80% of PQ problems, the most important power quality (PQ) issues two. According to the IEEE 1959-1995 standard, voltage sag 0.9 p.u. There is a decrease in the frequency of 0.1 and 1 min at the time of the half cycle RMS voltage level. Short circuit, abrupt load changes, starting with large motors, and transformers energization of the main causes of voltage sags. According to the nature of the definition and the voltage sag, the reasons for this is classified as low-or intermediate-frequency transient events can be seen as a transitory phenomenon.

In recent years, modern industries considering the use of sensitive devices, using different methods of compensation for voltage sags. PQ is one of the methods to improve and replace the load voltage using DVR. DVR the show different aspects of previous works have been completed, and the various control strategies have been found. These methods are often dependent on the purpose of using the DVR. Some of the methods, the main purpose of the DVR to recognize and minimum active power injection to compensate for voltage sag. Moreover, the compensation policy phej sag and swell can be used for relaxation. The construction of the multi-DVR DVR removing the battery and can be used for controlling more than one line.

Furthermore, research has been done on the use of medium-level voltage DVR. Frequency variations and harmonic mitigation studies are also under the control of the DVR. Load voltage and current feedback control, closed-loop control of the DVR to introduce a common method. Also, Posicast and P + resonant controllers to improve transient response and DVR can be used to eliminate the steady-state error. The controller is a kind of two parts Posicast phase function and transient voltage sag started from the starting point, is used to improve the damping oscillations. P + resonant controller has a proportional function plus echoed function and eliminates the steady-state voltage tracking error.

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Symmetrical parts of the feed forward and feedback methods to assess the strong control, and the wave of transition also proposed various methods of controlling the DVR.All of the above methods, the source of the disturbance is assumed to be on the feeder, which is parallel to the feeder DVR. In this paper, a multi-control system, the source of the disturbance DVR Posicast and P + resonant controllers using the load voltage when the rescue is proposed in parallel to the feeders. On the other hand, a bottom at the wrong time, the PCC voltage protects the fault current limiting devices, and protects itself from the current big mistake.

This paper, based on the proposed control strategy is not wrong when the DVR through the filter capacitor voltage of the current of the load with an internal feedback loop is used as an external feedback loop. As well as a load voltage feed forward loop is used to improve the dynamic response. Moreover, short-term exposure, Posicast controller to improve and eliminate the steady-state error, P + resonant controller is used. But using the wrong algorithm to control the current flow, DVR goes through, the series voltage injected in the opposite direction and therefore, DVR is a series of actions, such as variable impedance.

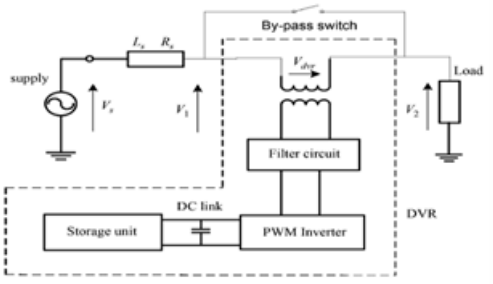

Fig 1: Typical DVR-connected distribution system.

II. FACTS:

The word "Facts" (Flexible AC Transmission Systems) AC power is used for transmission and distribution covers the power electronics based systems. Due to the nature of power electronics devices, FACTS solutions to the needs of one or more of the following features in particular will be called:

(A) rapid dynamic response
(B) the ability to output often contrasts
(C) to adjust the output smoothly.

Facts in shunt, series family of devices which can be inserted into the power grids, and in some cases, the shunt and series. FACTS Flexible AC transmission systems that, in the high-power electronic devices control the power systems has in recent years for a better word. FACTS devices have been introduced around the world for many different applications. There are several stages of the introduction of many new types of devices in practice. In most of the applications of power lines, substations and control upgrades, or additional to, for example, the cost of power systems that require intensive or territory to be used to avoid extensions. FACTS devices differences in operating conditions to provide a better follow-up and improve the use of existing installations.

Power electronic based flexible AC transmission

Systems (FACTS), the development and transfer of interconnected AC power transmission systems used to control the most economical and effective means. This high-capacity transmission lines to transport the power to force.

TYPES OF FACTS DEVICES

FACTS devices are launched with the capability of increasing the development of power electronic components. High energy levels high and also the highest voltage levels for the devices have been made available for the converters. The amount of reactive power or energy points in the early part of the system affects the network elements of the barrier. Figure 1.2 shows the traditional ones and FACTS devices, cutting the number of elementary devices. 'Dynamic' and 'static' classification requires some explanation for the facts. The term "dynamic" Facts-provided power electronics devices are used to notify the quick control. One of the major factors that differentiate it from the traditional devices.

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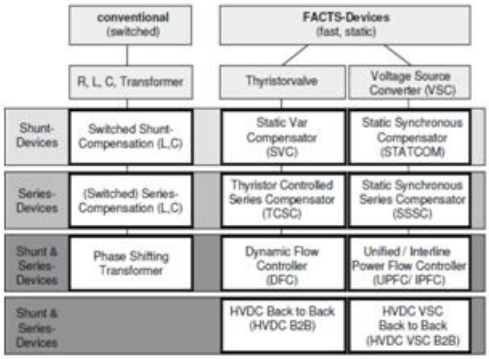
The term "static" dynamic control devices, such as mechanical switches with no moving parts to maintain. FACTS-devices and therefore more likely to be static and dynamic. Depending on the system, and one or more AC power to the electronic control of the transmission parameters of the offer and other static equipment.

Types of controllers Facts:

- Series
- Shunt
- Series shunt
- Series Series



Overview of major FACTS-Devices

Fixed left column to build the image above or mechanically resistant to conventional devices, such as transformers, together with the inductance or capacitance may be able to have the parts. FACTS devices in the left column uses the thyristor valves or converters. These valves or converters are well known from many years. Once they are converters because the valves of a wheel or the conversion of their low frequency of usage Thyristors just across the bridge impedances have a low risk profile. FACTS devices are insulated gate bipolar transistors in the right column (IGBT) or insulated gate commutated Thyristors (IGCT) voltage source converters on the basis of today's technology is more advanced. Voltage source converters, IGBTs or IGCTs due to the size of a pulse width modulation and phase voltage to provide a free controllable. High modulation frequencies to get the balance of the output signal is low and also allow for the replacement of disturbances coming from the network.

The disadvantage with an increasing switching frequency, the risks are on the rise as well. This replaces the need for separate samples of the converters.

III. DVR

The main objectives, (RMS values of currents, reducing the power demand of the line) to increase the capacity utilization of distribution feeders to reduce losses and improve the quality of the power load on the bus. The main assumption is to neglect variations
The source voltages. It is much slower than the source voltage indicates that the dynamics of the fate of the load. Rapid variations in the source voltage can not be ignored, as this is (a) semiconductor fabrication plants (b) paper mills (c), food processing plants, and (d) automotive assembly plants a®ect load performance can be complex. The most common source of voltage disturbances (i) arising in the transmission system, (ii) adjacent to the feeder faults and (iii) a fuse or breaker operation disturbances are due to the voltage sags or swells. 10% of critical loads, voltage sags lasting 5-10 times also result in costly damage.

Symmetrical or unsymmetrical faults arise due to voltage sags. In the latter case, there are also negative and zero sequence components. But the burdens of uncompensated distribution system supply voltage causes the harmonic components. To deal with the problems caused by the poor quality of power supply, compensators used in series connected. The primary application of voltage sags and swells to replace them in the literature, such as Dynamic Voltage Restorer (DVR) is called. If the configuration is discussed in chapter 7, SSSC is similar to the control methods are di®erent. Also, a DVR fast (less than 1/4 cycle) is expected to respond to the use of IGBT or IGCT devices employs PWM converters. On August 1996, the first DVR U.S.A a Duke Power system, which entered commercial service on the storage of energy with a rating of 660 kJ 2 MVA and 0.5 second (30 cycles) is capable of compensating for a period of up

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to 50% voltage sag. It is a stand-alone and rug weaving yarn manufacturing facility has been set up to protect.

Voltage Source Converter (VSC)

This could be a 3 phase - 3 wire VSC or 3 phase - 4 wire VSC. The latter permits the injection of zero-sequence voltages. Either a conventional two level converter (Graetzbridge) or a three level converter is used.

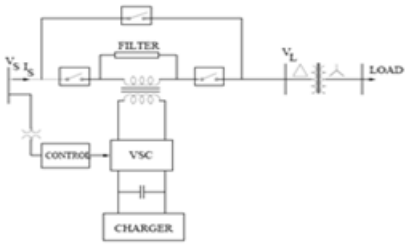

Fig 2: Dynamic voltage restorer

Boost or Injection Transformers

Three single-phase distribution transformers, high-voltage level, the pair VSC (low voltage level) connected to the distribution feeder series. Single transformers three-star / star of winding opened or Delta / opened to connect with the star of winding. In order to allow zero voltage of the second injection. Load the selection of the winding step down transformer that feeds the injection transport connections will depend on the former. If the transformer is used to connect to a ¢ ¡Y (Fig. 14.1 as shown in), in order to zero volt- ages need to be replaced. If used in connection with the retention y ¡y-neutral, zero-voltage compensation may be in order. It is imperative to avoid saturation in injection transformers.

Passive Filters

Passive filters can be placed on either side of the high voltage side or the boost converter transformers. Converter of the benefits (a) Components of low-voltage and (b) higher-order harmonic currents (up to VSC) are the filters on the side of the transformer windings rated by not own °.

Disadvantages filter inductor into a voltage (primary part of) the voltage and phase (angle) there is a shift. A®ect scheme can control the DVR. Disadvantages of a location of the high voltage side of the filter (transformer leakage reactance can be used as a filter inductor) to overcome, but the results of the high-frequency currents in the windings of transformers with a higher rating can ow °

Energy Storage

This is necessary to provide a deep voltage sags during the loading of the active force. ° ywheel or SMEs lead-acid batteries used for energy storage. It is fed from an auxiliary AC supply by supporting the bridge converter on the DC side of the VSC is also possible to provide the necessary power

IV. CONTROL STRATEGY

There are three basic control strategies as follows.

Pre-Sag Compensation

Supply voltage and load voltage is tracked continuously compensated by the situation in front of the landfill. This method (almost) undisturbed load voltage results, but generally require a higher rating for DVR. Before a landfill, V = VL = VO. VS1 to the size of the drop in the supply voltage results in a voltage sag. DVR is a load voltage VC1 voltage (VL = VS1 + VC1) vo is at that injects (both in magnitude and phase). It has been claimed that some of the loads and which are sensitive to fluctuations in the jumping phase and the need to replace the voltage sags.

In-phase Compensation

DVR injected voltage, regardless of the load current and the pre-sag voltage (VO) is in step with the supply voltage. This control strategy is injected voltage (intensity), the minimum value of the results. However, the phase of the load voltage is disturbed. Weights are not sensitive to the phase jumps, DVR voltage rating of the control strategy results in optimum use. These strategies are not zero power requirements for DVR

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Minimum Energy Compensation

Ignoring losses, DVR inside the power requirements of the zero voltage (VC) is a classification load current. To increase the voltage at the load bus, DVR and VL VS1 is injected by capacitive voltage leads. It should be noted that the current phasor is determined by
The bus load phasor voltage and load power factor.

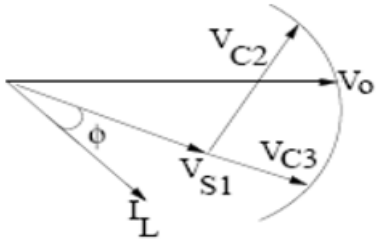

Fig 3: Phasor diagram

In addition to the power supply voltage of the implementation of the minimum compensation required to measure the load current phasor. VC when the load current classification, DVR only reactive power supply. However, the full load voltage, load power factor compensation, depending on the supply voltage is not possible unless at least the value of the above.

The VC is not constrained in size, with a power factor of intensity versus angle and the minimum value is still necessary VO allows full compensation. Load bus voltage. If the entry is limited to the size of the voltage (V max C), full compensation for the expressions and is given by the phasor diagrams to follow the mini mum supply voltage. The minimum voltage at the source of the current case (a) is in step with VS for the note.

V. SIMULATION RESULTS

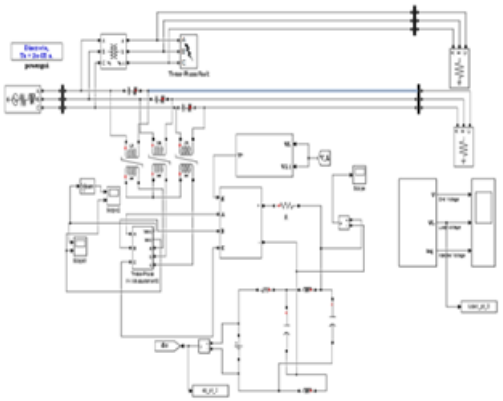

Figure 4: Simulation Circuit of System with DVR

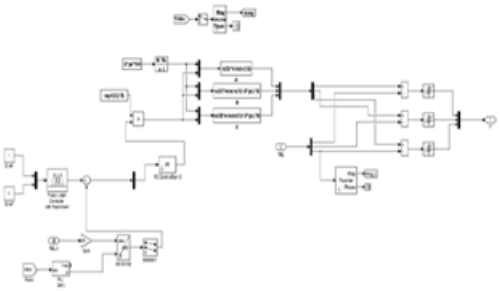

Figure 5: Control Circuit of DVR

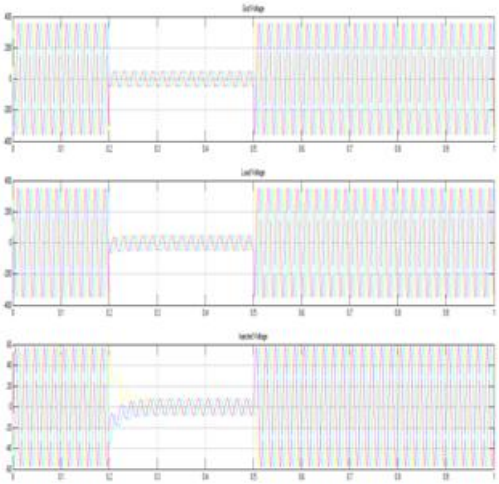

Figure 6: a) Source Voltage b) Load Voltage c) Injected Voltage without connecting DVR

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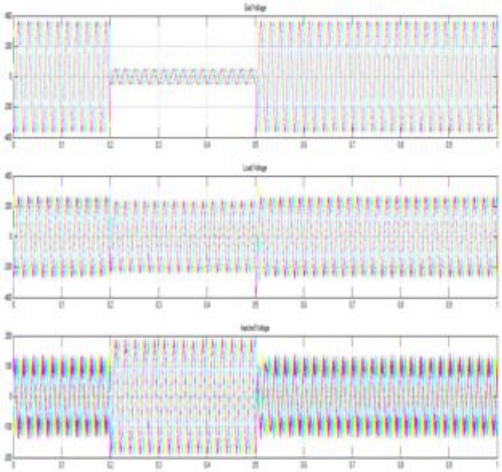

Figure 7: a) Source Voltage b) Load Voltage c) Injected Voltage with DVR

VI. CONCLUSION

PI controller integral gain value for the paper, which has been seen as the automatic tuning. We voltage sag compensation and swell, especially in the electricity distribution system for improving the quality, based on fuzzy PI Plus DVR have been done on the simulator.

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