Mitigation of Voltage Sag and Swell Using Direct Converter and Without Energy Storage System

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Abstract: Power quality is one of major concerns in the present era. It has become important especially with the introduction of sophisticated devices whose performance is very sensitive to the quality of power supply that results in a failure of end user equipments. To mitigate the problems caused by poor quality of power supply series compensators are used. When voltage sag happens the transformers are exposed to the disfigured voltages the compensator is likely to be interrupted due to its own over-current protection and eventually the compensation fails and the critical loads are interrupted by the voltage sag and swell. This project proposes an improvement of transient current response using inrush current mitigation technique of load transformer together with a state feedback controller for the voltage sag and swell compensator.

Keywords: Pulse Width Modulation, opt coupler, sag, swell

I. INTRODUCTION

The Power quality is major concern in industries today because of enormous losses in energy and money. With the advent of myriad sophisticated electrical and electronic equipment such as computers, programmable logic controllers and variable speed drives which are very sensitive to disturbances and non-linear loads at distribution systems produces many power quality problems like voltage sags, swells and harmonics and the purity of sine waveform is lost. Voltage sags are considered to be one of the most severe disturbances to the industrial Equipments. The fulfillments of the industrial goals were possible only because the modern industries were able to find innovative technologies that have successfully become technological developments. To provide the required quality power output may sometimes cause complete shutdown of the industries which will make a significant financial loss to the industry concerned.

II. EXISTING SYSTEM

The results of the analysis have been collected and compare in tabular form and represented in graphical form. To say more we show potential areas of application for particular solutions of ac voltage compensators. In old method they used stochastic approach to the comprehensive assessment of the impact of voltage sags on large-scale power networks. The approach takes into

account the stochastic nature of power system operation including load variation uncertainty of fault clearing time by protection relays fault rates of network components and the variation/uncertainty in equipment sensitivity to voltage sags. A new duration zone division method is used to derive sag duration and occurrence frequency based on the stochastic distribution of clearing time required by specific protection systems.

III. PROPOSED SYSTEM

The proposed direct converter design using the outputs of a single-phase inverter is connected to the utility supply via wyes-open connected series transformer. Once a voltage disturbance occurs with the aid of transformation based scheme the inverter output can be steered in phase with the incoming ac source while the load is maintained constant. As for the filtering scheme of the proposed method, output of inverter is installed with capacitors and inductors. The basic functions of a controller in a direct converter are the detection of voltage sag/swell events in the system computation of the correcting voltage generation of trigger pulses to the sinusoidal PWM based DC-AC inverter correction of any anomalies in the series voltage injection and termination of the trigger pulses when the event has passed. The controller may also be used to shift the DC - AC inverter into rectifier mode to charge the capacitors in the DC energy link in the absence of voltage sags/swells. The voltage sags is detected when The supply drops below 90% of the reference value whereas voltage swells is detected when supply voltage increases up to 25% of the reference value. The error signal is used as a modulation signal that allows generating a commutation pattern for the power switches (MOSFET's) constituting the voltage source converter. The commutation pattern is generated by means of the sinusoidal pulse width modulation technique (SPWM) voltages are controlled through the modulation. As a result they have less volume, weight, and cost. They can also compensate long-time voltage sags and swells. The proposed direct converter can compensate several types of disturbances such as voltage sags, swells, unbalances, Harmonics and flickers.

It is said that a voltage sag has taken place in an electrical network point when the voltage in one or more phases falls suddenly beneath an established limit generally a 90% of the normal voltage), and recovers after a short period of time usually between 10 ms and some seconds). The maximum limit of this period is that voltage sag exists when its duration reaches 1 min, or even 3min. The expected number of events during one year can oscillate between ten and a thousand.

C. Voltage Swell:

Voltage swells are usually associated with system fault conditions - just like voltage sags but are much less common. This is particularly true for ungrounded or floating delta systems, where the sudden change in ground reference result Ina voltage rise on the ungrounded phases. In the case of a voltage swell due to a single line-to-ground fault on the system, the result is a temporary voltage rise on the undaunted phases which last for the duration of the fault.

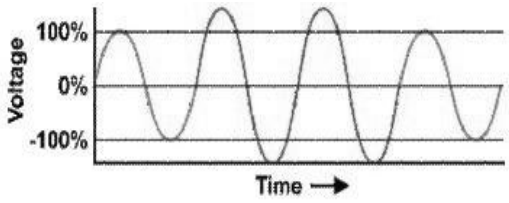

Fig.2.1 block diagram

IV. RELATED WORK

Power quality is very important issue recently due to the impact on electricity suppliers, equipment manufacture and customers. Power quality is described as the variation of voltage, current and frequency in a power system.

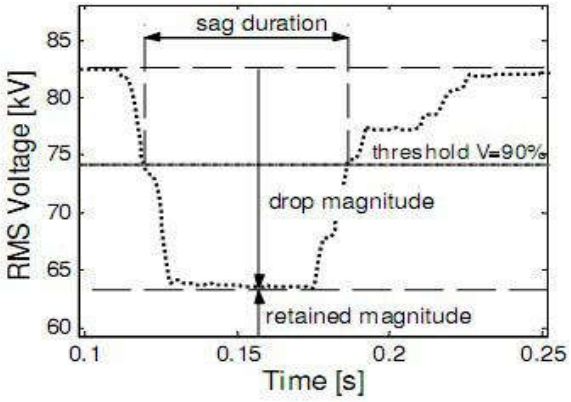

Fig.2.2. sag

Disturbance	Voltage	Duration
Voltage Sag	0.1 – 0.9 pu	0.5 – 30 cycle
Voltage Swell	1.1 – 1.8 pu	0.5 – 30 cycle

Fig 2.4. IEEE definitions of Voltage Sags and Voltage Swell

A. Performance Evaluation: *B. Voltage Sag:*

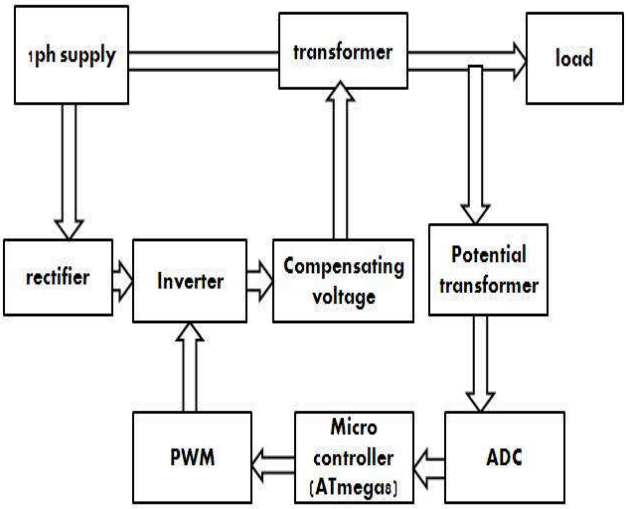

Fig.2.3. swell

V. CONCLUSION

Nowadays reliability and quality of electric power is one of the most discuss topics in power industry. There are numerous types of power quality issues and power problems and each of them might have varying and diverse causes. The types of power quality problems that a customer may encounter classified depending on how the voltage waveform is being distorted. There are transients, short duration variations such as sags, swells, and interruption and Long duration variations sustained interruptions, under voltages, over voltages, voltage imbalance, waveform distortion such as dc offset, harmonics, Inter harmonics, notching, and noise voltage fluctuations and power frequency variations. Among them two power quality problems have been identified to be of major concern to the customers are voltage sags and harmonics but this project is focusing on voltage sags. Voltage sags are huge problems for many industries and it is probably the most pressing power quality problem today. The proposed method can protect customer's equipment from potential voltage swells. This was proved with several simulation and Experimental results. These results validate the proposed strategy for the detection and control of the direct converter. These results also shown that the direct converter compensation is fast and the source voltage fault can be compensated by series voltage injection transformer voltage sags may cause tripping and large torque peaks in electrical machines. Generally voltage sags are short duration reductions in rms voltage caused by faults in the electric supply system and the starting of large loads such as motors. It is also created on the electric system when faults occur due to lightning which are accidental shorting of the phases by trees, animals, birds, human error such as digging underground lines or automobiles hitting electric poles and failure of electrical equipment. Sags also may be produced when large motor loads are started or due to operation of certain types of electrical equipment such as welders, arc furnaces, smelters etc.

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