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A Literature Survey On Power Quality Enhancement In Flicker Problem

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***Abstract*— In this review paper discuss the different voltage flicker problem that is generate due to voltage up and down. This voltage problem generates flicker, and power quality degradation. The main reason of flicker generation is load change. Mainly caused by the amplitude change, not depended on absolute change. In the last decade there are different research work proposed on this flicker mitigation problem. In this survey paper discuss the different method to reduces this problem that is shown in this paper. STATCOM and DSTATCOM both are major players to reduce this problem.**

***Keywords*— Power quality, Voltage flicker, STATCOM, D-STATCOM, etc...**

I. Introduction

It is often useful to think of power quality as a compatibility problem: is the equipment connected to the grid compatible with the events on the grid, and is the power delivered by the grid, including the events, compatible with the equipment that is connected? Compatibility problems always have at least two solutions: in this case, either clean up the power, or make the equipment tougher. The tolerance of data-processing equipment to voltage variations is often characterized by the CBEMA curve, which give the duration and magnitude of voltage variations that can be tolerated.

Ideally, AC voltage is supplied by a utility as sinusoidal having an amplitude and frequency given by national standards (in the case of mains) or system specifications (in the case of a power feed not directly attached to the mains) with an impedance of zero ohms at all frequencies.

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The unregulated flow of reactive power in a distribution network has been shown to negatively impact the feeder operation in many ways. For example, for the same amount of power, the current drawn from the source increases because of the low power factor at the feeder nodes. This further reduces the power transfer capability of the distribution feeder and increases the feeder active and reactive power losses. Reactive power (VAR) compensation is defined as the management of reactive power to improve the performance of ac power systems. The concept of VAR compensation embraces a wide and diverse field of both system and customer problems, especially related with power quality issues since most power quality problems can be attenuated or solved with adequate control of reactive power. Series and shunt VAR compensation are used to provide the required compensation. Traditionally, synchronous condensers and switched capacitors or inductors and static Var compensators (SVCs) has been used for reactive power compensation. With the advancement of more reliable high-speed power electronics and advanced control systems, STATCOMs based voltage source inverters (VSIs) have been used extensively to provide the required VAR and power factor correction. The existing VSIs however, make use of electrolytic capacitors which have well-known failure modes and have been shown to exhibit accelerated wear and tear in hot/arid climatic conditions. For this reason, the electrolytic capacitors are often regarded as the bottleneck components of a power electronic system, placing severe limitations on the overall service lifetime of a power electronic device. Failure types of DC capacitors are presented in with an estimated 30% of power electronics failures occuring mainly because of the capacitors.

The matrix converter (MC), is a direct AC/AC power converter. It has been developed as an alternative to the other indirect AC/AC converters such as voltage source inverters (VSI). The MC has advantages over other converters since the direct-form does not have a DC link capacitor, is compact, has a simple structure, can operate with unity power factor and can allow bi-directional power to flow. Without the electrolytic capacitor, the MC has the capability to achieve a longer service life, which is an important attribute for equipment installed in an electrical power system.

II LITERATURE SURVEY

Shahapure, S. B., & Hasabe, R. P. (2019, July) - In this presented authors recent scenario Distributed Static Compensator (DSTATCOM) resolves the current related power quality problems and Dynamic Voltage Restorer resolves the voltage related power quality problems. The Unified Power Quality Conditioner is the integration of DSTATCOM and DVR with common DC link. Due to the major advancements in Solar PV systems and its availability in reasonable cost at consumer end the world is moving ahead for Solar PV system for renewable energy generation. Generally,
the electrical power to the DC link is supplied from source side. This paper presents the UPQC with Solar PV system. In proposed system the electrical power is supplied to DC link of UPQC using Solar PV system. The proposed system is designed and implementation in MATLAB simulink environment. The performance of the proposed system is analyzed under various conditions of source voltage variation, load unbalanced
condition. After MATLAB simulation the proposed system is implemented in OP4510 Real Time Digital Simulator. **[01]**

Rohouma, W., Balog, R. S., Peerzada, A. A., & Begovic, M. M. (2019, April) - In this research work, a D-STATCOM based matrix converter controlled using MPC is presented. MPC is used to control the system. Synchronous reference frame method is adapted to generate the reference current for the MPC. The use of MPC to control the MC for the proposed DSTATCOM
can be extended for harmonic compensation techniques.
7.5KVA experimental setup is used to test the performance of the system, and the results presented above show that good reactive power compensation is achieved using the proposed capacitor-less D-STATCOM approach. Thus, this technique has the capability of becoming a new FACTS device. In the future, this work will be expanded to include harmonics compensation, and it will be coupled with one of the power system softwares such as OpenDSS to do system-wide simulations on a real distribution system under hot/arid climatic conditions, to assess the feeder operation in terms of feeder voltage profile and reactive power losses, with and without the D-STATCOM device.**[02]**

Atma Ram Guptaet. al, [2017] - In this research work authors aim of this paper is to analyze unbalanced radial distribution systems (UBRDS) with the distribution static compensator (D-STATCOM). The main objectives of this paper are D-STATCOM allocation in UBRDS within objective of providing reactive power support to enhance voltage profile and reduce line losses of the distribution network, determination of optimal D-STATCO Mating subjected to minimization of total cost, and impact of D-STATCOM placement on improving power factor and savings in cost of energy loss. The analysis is conducted on a large industrial load model with light, medium and high loading scenarios. Further, the impact of load growth is also considered for better planning of the power distribution system. The results are obtained on standard 25-bus UBRDS to check the feasibility of the proposed methodology.**[03]**

N. Visaliet. al, [2017] - In thesis work researcher presented Now-a-days, the most important discussing topic in the world of power systems is maintenance of power quality. After generating voltage, the engineers in the substations are struggling for transmitting as well as distributing of power to their ceiling end, since different loads at the ends of distribution are very sensitive to the fluctuations in the voltage, interruptions of voltage and harmonics. This paper shows the improvement of Voltage Sag and THD using LCL Passive Filter along with the Distribution Static Compensator (D-STATCOM) which works with the principle of Voltage Source Converter (VSC).**[04]**

AnjuBalaet. al, [2017] - This paper represents the Hard ware implementation of three phase three level inverter based DSTATCOM to reduce the THD. Inverter based DSTATCOM system using mc3phac IC. In this project mc3phac IC is used to generate PWM pulses with alternate phases these PWM signals are used to fire the IGBT. The system consists of mc3phac IC, IR2110 IC (IGBT drive IC), two voltage regulators (LM7805, LM7812). In this model IGBT is used to switch on and off in order to generate the required three phase output signal. In this work we utilized the Lab VIEW hardware NI-9171, voltage measurement module NI-9244 to acquire the real time data.**[05]**

R.Rageshet. al, [2017] - In this research work authors, the performance of a Single DSTATCOM is evaluated for the purpose of harmonics elimination, reactive power compensation and load balancing. A control scheme has been proposed for DSTATCOM and its characteristics are investigated by digital simulation. A current controller on the single-phase basis forms the innermost loop in the control hierarchy. The dc bus voltage controller and PCC voltage controller are designed using a simplified model, neglecting the dynamics of the inner current control loop. The control of DSTATCOM is accomplished by Space Vector Pulse Width Modulation (SVPWM) technique with potential of supplying reactive power, harmonics and unbalanced load compensation and it is used to provide real component of load current, positive sequence and fundamental frequency. The Proportional–Integral (PI) controller is used to compute current component to compensate losses in DSTATCOM to maintain dc-bus voltage of voltage source converter (VSC). **[06]**

B. Murugananthamet. al, [2017] - In thesis work researcher presented depleted conventional energy sources and awareness approaching Green gas emissions, have forced the countries towards the integration of Distributed Energy Resources (DER) in the secondary distribution network. While integrating DER in the Distribution Network (DN) the performance of the network varies with respect to the seasonal variation of source and load. In addition to this the DN experiences unbalanced load in each phase, variable peak demand and continuously varying load profile creating disproportion load flow between real and reactive power. With the variation in generation and load, dip in power factor and variation in reactive power flow is observed in the underground lines. This paper addresses the impact of real and reactive power allocation for the seasonal variation of source and load demand on IEEE 37 node test feeder. Solar PV is integrated at remote locations of the feeder and load flow analysis is performed for different load profiles. Time series simulations are performed to analyze the dynamic behavior of the network. The nodal voltage solutions and power flow solutions are explored with and without Distribution static compensator (DSTATCOM). Switching sequence of the DSTATCOM for different seasons is computed and the reactive power reallocation is done for the DN. The improvement in voltage profile and power factor at various nodes with DSTATCOM has been demonstrated. **[07]**

S.No.	Year	Ref.	Author name	Method	Result
01	2019	[01]	Shahapure,. et.al	Unified Power Quality Conditioner (UPQC) model	24.58%
02	2019	[02]	Rohouma, W. et.al	THD and DC voltage	1.55%-1.78%
03	2017	[03]	Atma Ram Gupta et.al	DSTATCOM	1.50 %
04	2017	[05]	AnjuBala et.al	DSTATCOM found	0.75 to 1.8
05	2017	[06]	R.Ragesh et.al	Space Vector Pulse Width Modulation (SVPWM)	
06	2017	[07]	B. Muruganantham et.al	Distribution Synchronous Static Compensator (D-STACTOM)	30%
07	2017	[08]	Sirjani, R. et. al	Distribution Synchronous Static Compensator (D-STACTOM)	
08	2016	[09]	Kandadai, V., et.al	Field-Programmable Gate Array (FPGA)	17.4% - 3.6%
09	2016	[10]	Mishra, S. et.al	Teaching-learning Based Optimization (TLBO)	4.68% - 46.38%.
10	2016	[11]	Biabani, M. A. K. A.. et.al	D-STATCOM model	21.28% - 41.31%

III. VOLTAGE FLUCTUATIONS

Each of these power quality problems has a different cause. Some problems are a result of the shared infrastructure. For example, a fault on the network may cause a dip that will affect some customers; the higher the level of the fault, the greater the number affected. A problem on one customer's site may cause a transient that affects all other customers on the same subsystem. Problems, such as harmonics, arise within the customer's own installation and may propagate onto the network and affect other customers. Harmonic problems can be dealt with by a combination of good design practice and well proven reduction equipment.

FREQUENCY

- Variations in the frequency.
- Nonzero low-frequency impedance (when a load draws more power, the voltage drops).
- Nonzero high-frequency impedance (when a load
- demands a large amount of current, then stops demanding it suddenly, there will be a dip or spike in the voltage due to the inductances in the power supply line).
- Variations in the wave shape – usually described as harmonics at lower frequencies (usually less than 3 kHz) and described as Common Mode Distortion or Interharmonics at higher frequencies.

VOLTAGE

- Variations in the peak or RMS voltage are both important to different types of equipment.
- When the RMS voltage exceeds the nominal voltage by 10 to 80% for 0.5 cycle to 1 minute, the event is called a "swell".
- A "dip" (in British English) or a "sag" (in American English the two terms are equivalent) is the opposite situation: the RMS voltage is below the nominal voltage by 10 to 90% for 0.5 cycle to 1 minute.
- Random or repetitive variations in the RMS voltage between 90 and 110% of nominal can produce a phenomenon known as "flicker" in lighting equipment. Flicker is rapid visible changes of light level. Definition of the characteristics of voltage fluctuations that produce objectionable light flicker has been the subject of ongoing research.
- Abrupt, very brief increases in voltage, called "spikes", "impulses", or "surges", generally caused by large inductive loads being turned off, or more severely by lightning.
- "Under voltage" occurs when the nominal voltage drops below 90% for more than 1 minute. The term "brownout" is an apt description for voltage drops somewhere between full power (bright lights) and a blackout (no power – no light). It comes from the noticeable to significant dimming of regular incandescent lights, during system faults or overloading etc., when insufficient power is available to achieve full brightness in (usually) domestic lighting. This term is in common usage has no formal definition but is commonly used to describe a reduction in system voltage by the utility or system operator to decrease demand or to increase system operating margins.
- "Overvoltage" occurs when the nominal voltage rises above 110% for more than 1 minute.

node for each gate is the resulting voltage divider which is formed due to the potential difference at the input ports of the gate.

IV. POWER QUALITY IMPROVEMENT TECHNIQUES AND SOLUTIONS

Basu et al (2002) have introduced power quality improvement techniques and solutions. The problems can be viewed as the difference between the quality of power supplied and the quality of the power required for reliable operation of the load equipment. Using this viewpoint, the power quality problems can be resolved in to one of the three ways, listed as follows:

- Reducing the power supply disturbances
- Improving the load equipment immunity to disturbances
- Inserting corrective equipment between the
- electrical supply and the sensitive loads

In these three options, the present work focuses on the third one, as appropriate correcting devices are needed to improve the load equipment immunity to disturbances. This type of equipment does not draw reactive and harmonic currents from the utility. Power quality of an entire plant or a group of customers can be improved by inserting the independent compensating devices at the point of utility-customer interface or other relevant points in the distribution grid. Power quality problems exist in power distribution through the feeders and the partial mitigation of these problems existed even before the advent of power electronic controllers. 12 These are called conventional mitigation techniques. The flow diagram shows the power quality improvement in power system solutions.

Harmonic resonance problems are sometimes found with the use of passive capacitor banks. Using the synchronous condenser, the resonance problems are eliminated, but they are expensive and their operation and maintenance are more costly. Both capacitor banks and synchronous condenser have a slow response. Static VAR Compensation (SVC) generates a considerable amount of harmonics that may have to be filtered. Due to their high cost, the SVCs are not economical for small power users. Tap-switching and ferro resonant voltage regulators were the only devices to compensate for under voltages and over voltages. However, it was not possible to compensate for short duration sags because fast control devices were not available. The conventional mitigation techniques are discussed by Arindam Ghosh et al (2002) in detail highlighting their deficiencies.

It must be appreciated that the above discussed conventional techniques are not flexible enough. Therefore it is imperative that better and flexible correcting devices are used for power quality problems. The implementation of such devices has become possible due to advances in power electronics and availability of fast acting controllers. Power electronic controllers provide a flexible choice and better performance to improve the power quality problems.

These modern power electronics based systems are called custom power devices. There are many custom power devices and they are divided in to two groups. They are as follows.

- Network Reconfiguring type Solid-State Transfer Switch (SSTS). These devices are much faster than their mechanical devices.
- Compensating types The compensating devices either compensate a load and correct its power factor or improve the quality of the supply voltage.

COMPENSATING TYPES

Compensating type devices are as follows. Distribution Static Compensator (DSTATCOM) to compensate load reactive power and current harmonics. Dynamic Voltage Restorer (DVR) for supporting the load voltage. UPQC with PV which solves the power quality problems. The present work focuses on the last custom power device because PV based UPQC is much more flexible than separately configured DSTATCOM and DVR, which is a combination of a shunt and a series device. Moreover, there is no energy storage element for long interruption, whereas PV based systems provide better performance. An overview of the major custom power devices are discussed in detail as below.

V.CONCLUSIONS

In this survey paper discuss on Power Quality Enhancement In Flicker Problem. The important outcomes of this paper are shown in the section of comparative analysis. In this survey paper observe that the based on Power Quality Enhancement. Also most of the design Power Quality Enhancement suffers from lower gain problem. In future design a better Power Quality Enhancement In Flicker Problem. That can improve all these problems in this communication area. In future try to design Power Quality Enhancement In Flicker Problem.

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