

A Review on Power Quality Improvement Issues, Problems & Their Effects with Suitable Corrective Methods

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Abstract: - The ever increasing demand of power there is a need to expand and upgrade the modern power system .for the reliability and stability of the power system network it is essential to maintain good quality of power supply. The latest technologies used in distribution system and industrial sector are depends upon the power electronics based devices. Which are the greater sources of nonlinear loads and harmonics in power system. Poor power quality can cause voltage sag, swell, generation of harmonics, equipment failure due to large current, voltage, frequency imbalance. It's very important to awareness of power quality. This paper present review about power quality issues, its problems and corrective methods.

Key words: - *Power quality, nonlinear loads, power quality problems.*

Introduction: - Over the past decade the subject of power quality has been given an increased attention all over the world. Power quality is an integrated part of power engineering. Power quality is a set of electrical boundaries that allows a piece of equipment to function in its intended manner without significant loss of performance or life expectancy [1]. Ever a few years back the main concern of consumers of electricity was the reliability of supply it means continuity of electric supply. But now a day's power quality too is very important there are very sensitive loads that require clean and uninterrupted power such as air traffic control, processing plants (fabric, food, semiconductor, rayon etc.), hospitals (life support, operation theatre, patient data base system), bank security system etc. power quality problems like voltage sag ,swell, flicker, harmonics voltage distortion are various power quality problem create power quality poor they cannot be completely eliminated but minimized up to a limit through various equipment such as power factor corrector circuit ,facts devices ,filters etc.In this paper we will review some general power quality issue and related remedies[2][3].

POWER QUALITY PARAMETERS AND TERMINOLOGYS:-

Power quality is a measure of various parameters like voltage current and frequency within its predefined range. If there has any deviation generated various problems like voltage sag, voltage swell, transient, flicker, harmonics etc.which can be responsible for poor power quality.

3.1 Transient: - transient are short duration and sudden disturbances which can cause by a very rapid change in the steady state condition of voltage current or both. Transient disturbance is classified in to two categories oscillatory transient and impulsive transient. [4]

3.2 short duration voltage variation: - in any supply voltage if there has any variation for very short time not more than 1 minute is called a short duration voltage variation. For the short duration voltage variation faults, energization of large loads intermittent loose connection in power wiring is responsible. Short duration voltage variation is classified in to three categories as voltage sag voltage swells and interruptions. [2]

3.3 long duration voltage variation: - for larger than 1 minute the voltage deviation surrounding the rms (root mean square) value of power frequency is called long voltage variation. Long duration voltage variations are classified in 3 categories as over voltage, under voltage and sustained interruptions. [3]

3.4 wave form distortion: - the voltage and current waveform of healthy power supply are ideal sine wave .if there power frequency wave form has any steady state deviation is called wave form distortion. Wave form distortion is classified in to following categories .dc offset, harmonics, interharmonics, notching, and noise. [3]

3.5 voltage fluctuations: - the systematic random variation of voltage envelop is called voltage fluctuation. The main course of voltage variation is rapid change in current magnitude of load. A very rapid change of supply voltage

is called voltage flicker which is a type of voltage fluctuations. [2][3]

3.6 power frequency variations :- for the satisfactory operation of any power system an fundamental frequency is predefined .in case there has any variation in its specified nominal value (e.g. 50 to 60 Hz) is called power frequency variation.[2][3].rapid changes in the load which is connected in the system is responsible for power frequency variation .

4. POWER QUALITY PROBLEMS:-

4.1 poor load power factor:-the ratio of the real power flowing to the load to the apparent power in the electric circuit is called the power factor of the power system .it is an very important term of power system .the capacity of the circuit for doing work in a particular time is called real power and product of current and voltage is called apparent power. In power system because of various use of semiconductor devices or nonlinear load the wave shape of voltage and current are distorted which create the apparent power will be greater than the real power and get low power factor in the circuit. In case the power factor is low in an electric power system the amount of current flowing in the circuit draws more than a load with a high power factor for the same amount of useful power transferred. When the circuit has high current the energy lost in the circuit is higher and required larger wires and other electric equipment. [5]

4.2 harmonics: - harmonics are sinusoidal voltage or current components having frequency are integer multiples of the supply frequency. Distortion means the alteration of the original shape of an object image sound waveform or other form of information and representation. Harmonics are also a type of distortion which changes the voltage and current waveform of fundamental power frequency. Various nonlinear loads , power semiconductor devices,flurescent lamps adjustable speed drives personal computers etc. are generated harmonics in power system .this create various harmful effect in system it can reducing the efficiency of system, plant mal-functioning of equipments , aging of installation ,overheating and failure of machines ,overloading of power factor correction capacitors and power transformers.[6]

4.3 notching in low voltage:-when the current is commuted from one phase to another phase some disturbance in voltage waveform is called voltage notching .this is a type of power quality disturbance .voltage notch disturbs the voltage waveform and excites the natural frequency of the system usually these frequency range are in radio frequency range .which introduce the harmonic and non-harmonic frequency that are much higher than those found in higher voltage system .excision frequency create high frequency oscillations in the voltage of converter circuit .voltage notch damage capacitor banks ,create parallel resonance ,signal interference in logic and communication circuit, over loading in electromagnetic filters.[7]

4.4 voltage imbalance: voltage imbalance or unbalance is the ratio of maximum deviation from the average of 3 phase voltage and current to average of 3 phase voltage and current .there are many regions are responsible for the voltage unbalance such as unbalance incoming supply lines, nonequable transformer tap setting ,large single phase distribution transformer on the system ,faults in power transformer grounding ,open delta connected transformer banks ,unequal impedance in conductors of power supply wiring ,heavy reactive single phase load such as welders etc.[8]

4.5 disturbance of supply power: - for a good power quality of a power system required completely sin wave of voltage and current. But interruption, distortion, sag, swell, flicker, over voltage, under voltage etc. are the disturbance in supply power which are responsible for various types of power loss in the system. Small duration voltage interruption create relay tripping over heating in the system, burning power supply, damage semiconductor component and many problem.

Corrective methods: - power quality problems cannot be completely removed but it can be minimized up to a limit .for the limitation of this various methods are used

1. Power factor corrector circuit: - single-phase and three-phase automatic power factor correction systems have certain reactive current corrective power ratings. When the detected reactive power absorbed by the load is greater than the compensator rating, the power factor will not be corrected to unity, but certainly will be improved and the apparent power supplied by the ac supply will be reduced. and the quality of power supply is improved .[5]

2. FACTS devices: - Flexible Alternating-Current Transmission Systems (FACTS)

Is a recent technological development in electrical power systems. Due to the, every time higher requirements of the liability and quality of the electricity the implantation of devices capable of guaranteeing these requirements will keep increasing. FACTS devices are improving the operation of an electric power system. The influences of such devices on steady state variables (voltage levels, transmission losses, and generating costs) are very remarkable power quality benefits. [9]

1. Filters- Filters are generally used for power quality improvement by minimizing various problems like poor power factor, voltage distortion, current distortion etc. there are three types of filters being used- passive filter, active filters and hybrid filters. Passive filter are based on the R, L and C loads .active filters are very reliable and mostly used power quality improvement equipment in

power system. Hybrid system is combination of both active and passive system and works very effectively for harmonic and other waveform distortion in the system.

CONCLUSION: -

This paper presents a review on power quality terms, problems and their corrective methods. poor power quality can create many serious effect on our power system like overheating in system equipment, over loading, harmonics generations, waveform distortion etc. which can be mitigated through various techniques through filters facts devices and power factor corrected circuits etc.this paper will be helpful for researchers, users and suppliers of electrical power to get a guideline about the power quality.

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