International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 06 | June -2017 www.irjet.net p-ISSN: 2395-0072

Power Quality Effects on Nonlinear Loads

Ms. Bhagyashri S. Patil[1], Prof. V.S.Pawar[2]

PG Student [EPS], Dept. of Electrical Engineering, SSBT COET, Jalgaon, M.S India[1]
Assistant Professor, Dept. of Electrical Engineering, SSBT COET, Jalgaon, M.S India[2]

Abstract: - *With increasing the quantity of harmonics generating devices in power systems, the matter of their impact on the performance of system elements like induction motors, Personal laptop, CFL, Air Conditions and printers wants any assumption. The use of nonlinear loads is increasing day by day. This increasing use of nonlinear loads has created a lot of distortions in current and voltage waveforms. This enhanced power quality disturbances has result in numerous optimizations techniques and filter styles. Harmonic distortions are the main cause for power quality issues. About, of 60% in all over the globe are nonlinear loads. So, study of their conditions below serious harmonic contaminated networks would be attention-grabbing for understanding of that however we should always treat with the electrical load. For this analyzing the harmonics present in nonlinear loads is critical. Here a survey is formed to indicate details of harmonics gift in numerous nonlinear loads.*

***Key-Words*: - Harmonics, Nonlinear load, CFLs, TV, Power factor, THD, Harmonic Distortion, Power quality.**

1. INTRODUCTION

The main objective of the electrical utility is to deliver curving voltage at fairly constant magnitude throughout their system. This objective is difficult by the actual fact that there are hundreds on the system that turn out harmonic currents. as a result of electrical devices that act as nonlinear loads draw current non dimensionality, they're accountable for injecting harmonic currents into the electricity network. Harmonics may be a lot of vital issue for the business, commerce and therefore the home shopper currently than it absolutely was many decades past. The equipment's in laboratory area unit Compact Fluorescent Lamps (CFLs), Personal Computers, Laptops, Printers and Air Conditions wherever all of them is equally as harmonic vital. There are many causes of harmonics in a very facility. In distribution system, transformers area unit capable of producing harmonics thanks to core saturation. The consequences of harmonics on instrumentality are: extra heating and better insulator stress on the capacitors, interruption capability of circuit breakers, the electrical phenomenon of the conductors, scale back lamp life, activity errors in instrument like wattmeter, meter etc, heating, rhythmic torsion and noise on rotating machines. The value to finish users comes once the harmonic currents is additional to the traditional load and increase losses and loading on their distribution systems. The increased losses scale back the capability of the system, together with conductors, transformers. The increased loading generates heat and accelerates the aging of power instrumentality, like transformers.

Harmonic distortion isn't new and it constitutes at this time one among the most issues for engineers within the many stages of energy utilization inside the ability industry. Within the past, harmonics described less of a retardant because of the conservative style of power instrumentation and to the common use of delta-grounded wye connections in distribution electrical device. But, the increasing use of nonlinear loads in industry is keeping harmonic distortion in distribution networks on the increase.

2. HARMONICS: CAUSES & EFFECTS

In a perfect power grid voltage and current waveforms are strictly curved. In practice, non-sinusoidal currents result once the current flowing through the load is nonlinearly involving the applied voltage.In an exceedingly straightforward circuit containing solely linear circuit components (resistance, inductance and capacitance), current that flows is proportional to the applied voltage. In order that it leads to a ac current flow. Things wherever the load is straightforward full wave rectifier, current flows only if the provision voltage exceeds that keep on the reservoir capacitance. It says that waveforms tend to distort from the sine wave and this is often the cause for harmonics. Non-linear loads produce harmonics by drawing current in abrupt short pulses, instead of in an exceedingly sleek curved manner. Power grid issues involving harmonics are rare however it's attainable for variety of undesirable effects to occur. High levels of harmonic distortion will cause many effects like enlarged electrical device, capacitor, motor or generator heating, false operation of equipment (which depends on voltage zero crossing detection or is sensitive to wave shape), incorrect readings on meters, false operation of protecting relays, interference with phone circuits, etc. Since harmonic distortion is caused by nonlinear components connected to the facility system, any device that has non-

linear characteristics can cause harmonic distortion. samples of common sources of power grid harmonics, a number of that ne'er cause serious issues, are: electrical device saturation and influx, electrical device neutral connections, MMF distribution in AC rotating machines, arc furnaces, fluorescent lighting, pc switch mode power provides, battery chargers, imperfect AC sources, variable frequency motor drives (VFD), inverters, and tv power provides.

3. NON LINEAR LOADS

Due to the changes in the operating conditions and the rapid growth of advanced power conversion devices, electronics equipment's, computers, office automation, air-conditioning systems, adjustable speed heating ventilation can cause current distortions. This is due to increase in harmonics drastically. According to the Electric Power Research (EPR) in 1995, 35-40% of all electric power flows through electronic converters. All these devices are named as non-linear loads and become sources of harmonics.
The measurement results for the several modem set of non-linear based on is tabulated in Table.1.
In this paper a survey is done for various non -linear loads to know the levels of harmonics present in each loads.
These surveys are generally conducted with the objectives such as

- Identify the trends of harmonic distortion level present in the system,
- Identify the future trends of metering in the presence of non-sinusoidal current and voltage waveforms. And increased awareness and concern for customer's quality of service.

Here survey of various non linear loads is done. In that we can see the result of the same without & with using 'Active Filter'. For the better performance of non linear loads and to reduction of harmonics we used active filter. Here various loads and its harmonics are studied in detail. Before analyzing the harmonic effect; we define the characteristic and some model of equipment with their results as below:

4. CHARACTERISTICS AND MODELING OF EQUIPMENT

One important step in harmonic analysis is to characterize and to model harmonic source and all components in system. As we know, the equipment's in Power System Analysis & Control laboratory UniMAP are Compact Fluorescent Lamps (CFLs), personal computer, Television where all of them can be similarly as industry medium scale. Each equipment can be modeled as follow:

Table.1 the measured results for the modern set of non-linear loads

Non Linear Load	THD %	THD %	3rd (%)	5th (%)	7th (%)	9th (%)	11th (%)
Television	2.111	96.74	100	80.20	49.45	20.60	4.0
Laptop	3.16	83.8	49.6	43.8	36.2	27.5	17.7
PC	3.167	179.59	100	90.06	82.02	72.15	44.92
Fluorescent Lamp	3.07	11.1	32.2	27.5	6.8	6.5	6.1

4.1 Personal Computer

Personal computer has considerably contributed to harmonics issue by lowering voltage distribution system. The current ThD for private pc exceed one hundred, because the results of high level individual distortions introduced by the third and fifth harmonics. The full current drawn by laptop computer and its monitor is a smaller amount than two A, however a typical high-rise building will contain many hundred computers and monitors. The net impact of this on the full current harmonic distortion of a facility isn't tough to examine. And in fig.3 & 4 shows the SIMULINK model of PC and their comparative harmonics distortion.

4.2 Compact fluorescent lamp

The CFL was the primary major advance to be a commercial success in small-scale lighting since the tungsten incandescent bulb. Fluorescent lamps are concerning two to four times as economical as incandescent lamps at manufacturing lightweight at the wavelengths that are helpful to helpful to humans. because of significant use of non-linearity gas lamp, the fluorescent lamps that use magnetic or electronics ballast that are thought of as a major contributor to harmonic. Fig.1. shows the simulation model of one kind of lamp and fig.2.shows the waveform of current harmonics of this kind of lamp.

4.3 Television

Television receivers have power supplies which create current harmonics. Whilst the harmonic current levels are small in magnitude, the cumulative effect of large numbers of receivers can be significant. One way to examine the effect of television receivers on network harmonic levels is to

monitor harmonic levels during periods of increased television viewing in fig. 5 &6.

4.4 Air conditioning

Air conditioner makers have responded by exploring a range of technological innovations to extend the energy efficiency of their product. One example of innovation is that the variable speed cooling system, with enhanced efficiency gained by application of power electronics technology. The bulk of air conditioners contain a mechanical device driven by a single-speed induction motor, and exhibit mounted efficiency and cooling capability. Studies indicate that variable-speed air conditioners need four-hundredth less energy than single speed air conditioners, and are capable of conjugation a given cooling load at well reduced energy prices.

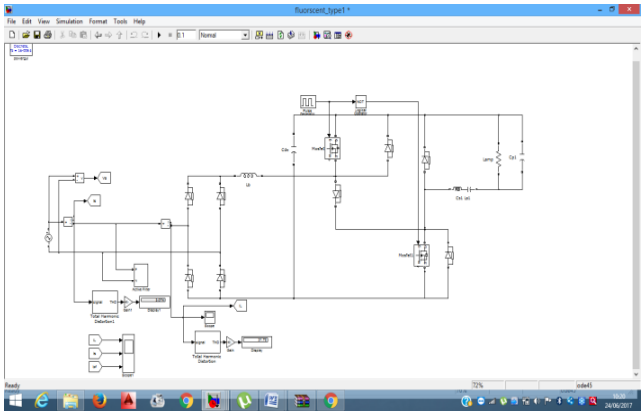

Fig.1.SIMULINK/MATLAB model of Fluorescent lamp with active filter

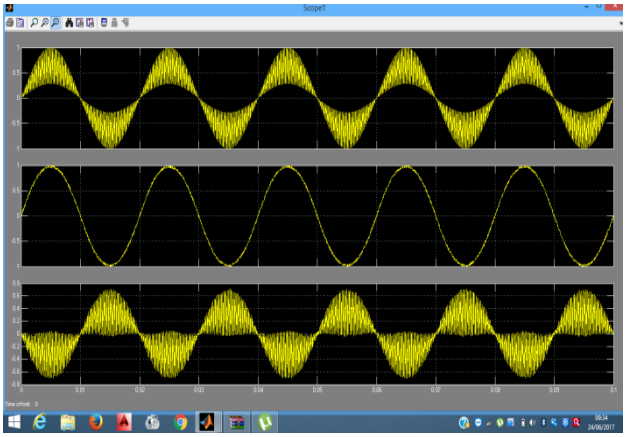

Fig.2. Waveform of Fluorescent lamp

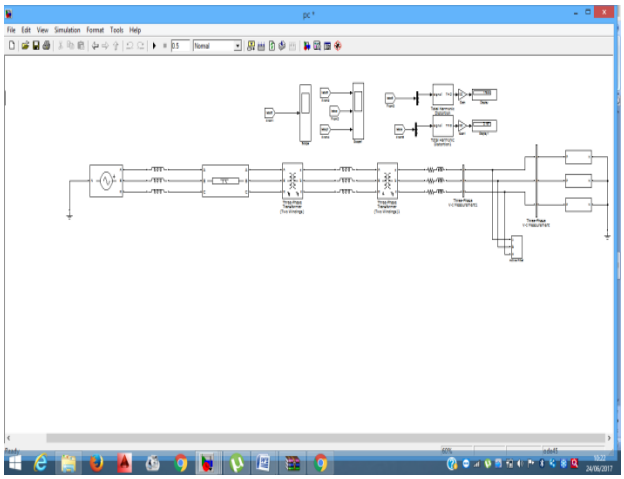

Fig.3. SIMULINK/MATLAB model of Personal computer with active filter

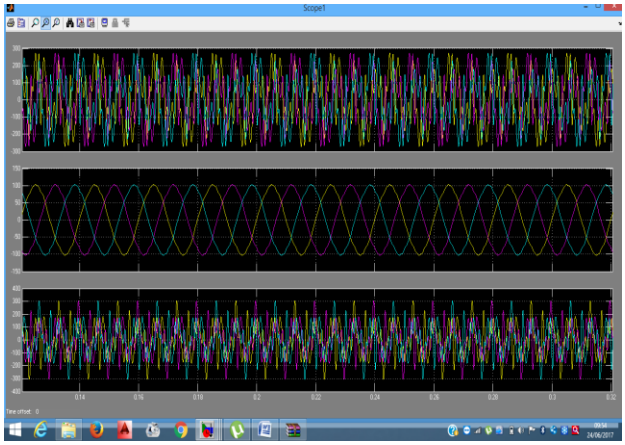

Fig.4. Waveform of PC with & without distortion

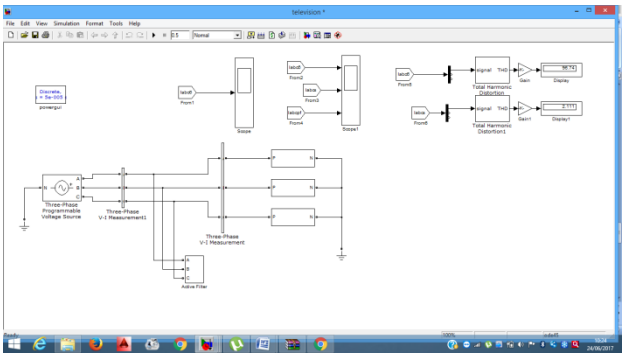

Fig.5. SIMULINK/MATLAB module of TV

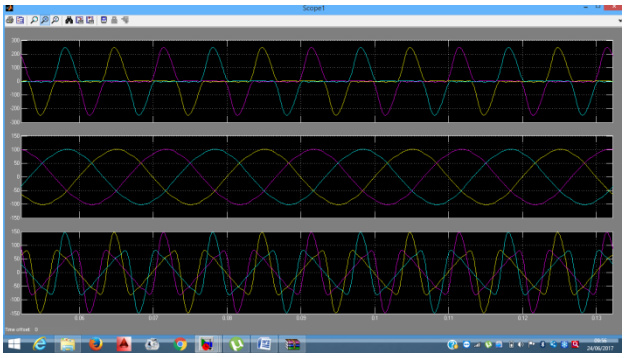

Fig.6.Waform of Tv

5. CONCLUSION

A survey of harmonics present within the voltage associated current waveforms is conducted with an objective to understand {the existing the prevailing the present} level of harmonic distortion present within the installation and future trends. Harmonics injected by some terribly usually used nonlinear loads are studied. It's determined that important distortion within the current exists because of the employment of computers and alternative electronic equipment's in residential and industrial areas too. Increasing use of those equipment's could end in serious issues in close to future. the present distortion differs wide from one section to the next. Although, voltage distortion is recorded below the suitable limit, however it's found higher than the counseled limit at the places of high current distortion, because it depends on the circuit resistivity additionally as harmonic generation characteristics. important distortion within the current is recorded at client finish with high share of fifth and seventh harmonic elements. tho' numerous optimisation techniques are present, analysis is being in deep trouble the simplest eliminated results of THD.

REFERENCES

[1] J. Arillaga, et al, "Power System Harmonics" ISBN 0-471 - 90640-9.
[2] Copyright Hawaiian Electric Company, Inc. 2004 "A Harmonics primer".
[3] IEEE Std 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
[4] J.L.Hernandez , MA. Castro, J. Carpio and A. Colmenar, "Harmonics in power systems" in International Conference on Renewable Energies and Power Quality (ICREPQ'09).
[5] Square D "Product data bulletin" Power System Harmonics Causes and Effects of Variable Frequency Drives Relative to the IEEE 519-1992 Standard. Bulletin No. 8803PD9402 August, 1994 Raleigh, NC, U.S.A.
[6] Allen-Bradley "Power system harmonics- A Reference Guide to Causes, Effects and Corrective Measures" in Rock well automation, A Reference Guide to Causes, Effects and Corrective Measures.
[7]Lorenzo Cividino-Power products development manager "Power Factor, Harmonic Distortion Causes, Effects and Considerations", Telecommunications Energy Conference, 1992.INTELEC '92.14thInternational , 1992 , Page(s): 506 – 513.
[8] Joseph.S, Sunbjak.JR,Johns.Mcquililkin-Members IEEE," Harmonics - Causes, Effects, Measurements, and Analysis: An Update" IEEE transactions on applications, vol. 26. NO.6 November/December 1990.
[9]M.I.AbuBakar"Assessments for the Impact of Harmonic Current Distortion of Non Linear Load In Power System Harmonics", Transmission and Distribution Conference and Exposition: Latin America, 2008 IEEE/PES, 2008 , Page(s): 1 - 6.
[10] David Kreiss "Increasing levels of non linear loads adds to harmonic woes" Vol. 1 No. 2 Summer 1995 A Quarterly publication of DranetzTechnologies,INC. Powercet corporation and Kreiss-Johnson Technologies.
[11] Dr. R.K. Tripathi, Member, IEEE & Mr. ChandreshverPratap Singh" Power Quality Control of Unregulated Non-linear Loads 978-1 -4244- 8542-0/10/$26.00 ©2010 IEEE
[12] Gonzalo Sandoval,ARTECHE / INELAP S.A. de C.V." Power Factor in Electrical Power Systems with Non-Linear Loads".