ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

Improvement of Power Quality by Reduction of Harmonics

Mercy.P[1], Kousalya.R[2], Rubeshkumar.N[3], Venkateshwaran.S[4]

Assistant Professor, Dept of EEE, Info institute of Engineering, Coimbatore, Tamil Nadu, India[1]

UG Student [EEE], Dept of EEE, Info Institute of Engineering, Coimbatore Tamil Nadu, India.[2]

UG Student [EEE], Dept of EEE, Info Institute of Engineering, Coimbatore Tamil Nadu, India[3].

UG Student [EEE], Dept of EEE, Info Institute of Engineering, Coimbatore Tamil Nadu, India[4].

ABSTRACT: Harmonics is basically considered as major quandary in power systems. In recent days Even though, this new highly efficient electronic technology improves power quality by the use of smaller and lighter electrical components, they are the source of harmonics. By using this electrical components the current and voltage wave form get distorted. It will not obtain a sinusoidal waveform. When waveform get distorted the output will not be proper so that the efficiency will be minimized. So that, to reduce this problem harmonic reduction technique is enabled. One of the best method of harmonic reduction technique is by using Passive filter method. In passive filter method LC filter is used. The LC filter will reduce high frequency AC component from a rectified output. It will suppress harmonic current and will reduce voltage distortion in various sensitive part of the system. The main advantage of this scheme is cost is low, they do not need any additional supply and large amount of current, voltage and power is handled. The reduction of harmonics is experimentally verified.

KEYWORDS: Total harmonic distortion, LC filter, Asynchronous machine, High voltage system.

I. INTRODUCTION

Increase of harmonic distortion is becoming an important factor in commercial and industrial side now-a-days. The reduction of harmonics in this side is becoming mandatory for Engineers in recent surveys. The harmonics mostly generate in low voltage side due to connection of non-linear loads. The generated harmonics will be divided into three categories that is, positive sequence harmonics, negative sequence harmonics and zero sequence harmonics. The current components such as 7^{th}, 13^{th}, 19^{th} are the positive sequence harmonics. The current components such as 5^{th}, 11^{th}, 17^{th} are the negative sequence harmonics. The negative sequence harmonics are excessive in phase line which improves the total harmonic distortion (THD). The zero sequence harmonics is also known as triple harmonics such as 3^{rd}, 9^{th} and 15^{th}. The zero order harmonics flow through the neutral wire and may cause overheating in that wire.

The reduction of this harmonics will be done by harmonic reduction method, such as by using Passive filter method. One of the best filters is a combination of Inductor (L) and Capacitor(C) commonly known as LC filter. The LC filter is also known as CHOKE filter. In electronics the choke is basically an inductor used to block high-frequency alternating current (AC) in an electrical circuit. It will block high frequencies while passing low frequency. The value of the Inductor and Capacitor used in this choke will be designed according to the requirements. The Inductor and Capacitor can be connected in parallel and in series. Although connecting in series configuration, it is more common to connect filters in parallel

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

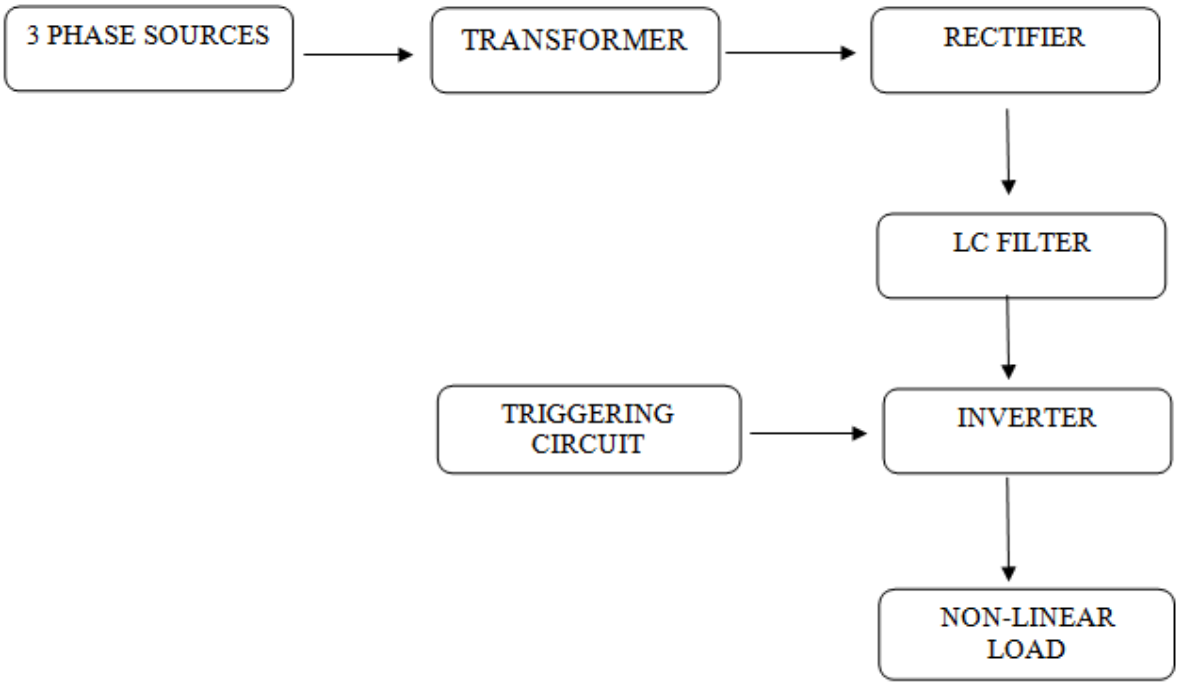
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

II. SYSTEM MODEL



BLOCK DIAGRAM EXPLANATION:

The three phase 415 V,50 HZ AC supply is used and it is given from EB lines. All the end users are connected at PCC (POINT OF COMMON COUPLING). It is given to the 415 V/ 415 V, 1 KVA three phase transformer is used. Primary winding is helical type winding and secondary winding is disc type winding. It is core type of construction. And it also having ±5 % voltage variation tapings. From the transformer the supply is given to the Rectifier which will convert AC to DC supply. In rectifier IN5404 diode is used, 3.0 ampere operation at T A=75 □ C. If the three phase current passes through D1, D2, D3, D4 , D5, D6 paths. R phase is passed through diode D1 and D2, Y phase is passed through diode D3 and D4, B phase is passed through diode D5 and D6 and all the three phases are converted in to corresponding DC output. The rectified output is given to the designed filter which will suppress high frequency and project to the Inverter. The inverter will convert the DC supply to AC supply because the loads should be supplied AC current. The inverter gets triggered using a triggering circuit. The inverter of CPV362M4U IGBT is used. Its temperature coefficient is 90 □C and supply voltage is360 Vdc. Power factor 0.8. From the inverter output it is given to the loads. The loads may be asynchronous motor, fluorescent lamp, LED bulb etc.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

III. OVERALL HARDWARE SETUP

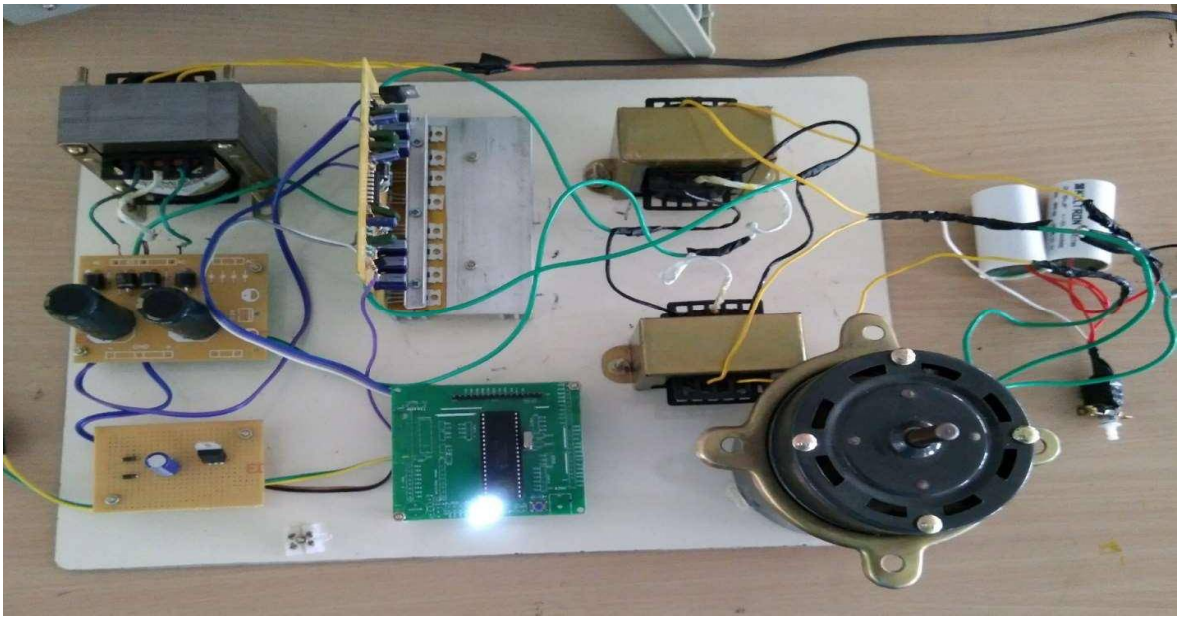


Fig 1: Overall hardware arrangement for reduction of harmonics in three phase transformers

IV. SIMULATION AND HARDWARE ANALYSIS WITHOUT FILTER

The simulation circuit was designed using MATLAB professional software versionv1.242. the components used in the simulation is picked from the library and connected approximately as in Fig 3. In Fig 3 the rectifier is connected to the inverter without any additional filter connections. The scope is connected to get the output of the input terminals and to measure the performance of the Asynchronous motor. The waveform gets greatly distorted in the performance of motor**.**

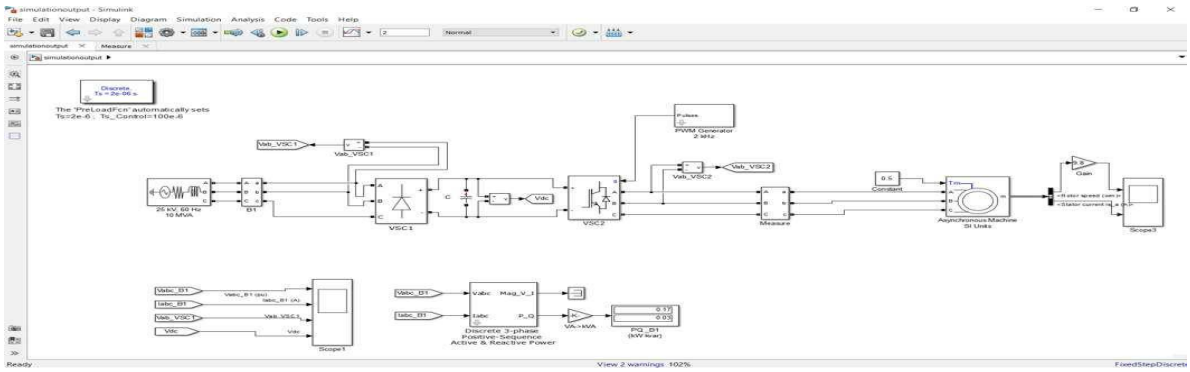


Fig 3: Simulation output without using Filter

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

Fig 3: Hardware output without using Filter

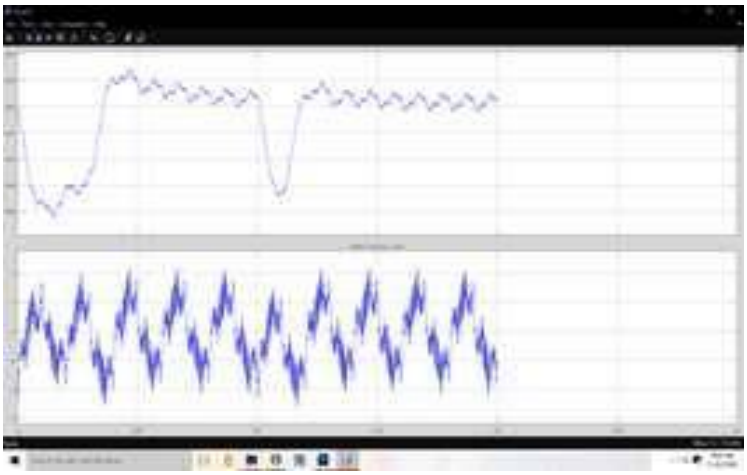


Fig 4: Performance of motor without filter

IV. SIMULATION AND HARDWARE ANALYSIS WITH FILTER

Fig 5 shows that; the designed filter is connected in between Inverter and the non-linear load. The filter is a LC filter. The total harmonic distortion value will be very much reduced on connecting this filter. The graphical representation of the total harmonic distortion is shown in Fig 8 and 9. The motor performance is viewed in scope. Before the connection of filter, the waveform is very much distorted but, after connecting the filter the distortions are very much reduced. So that the efficiency of the motor is increased. The simulation output of the performance of motor

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

is shown in Fig 7. The hardware DCO also shows the greater reduction of distortion of wave form after connecting the filter.

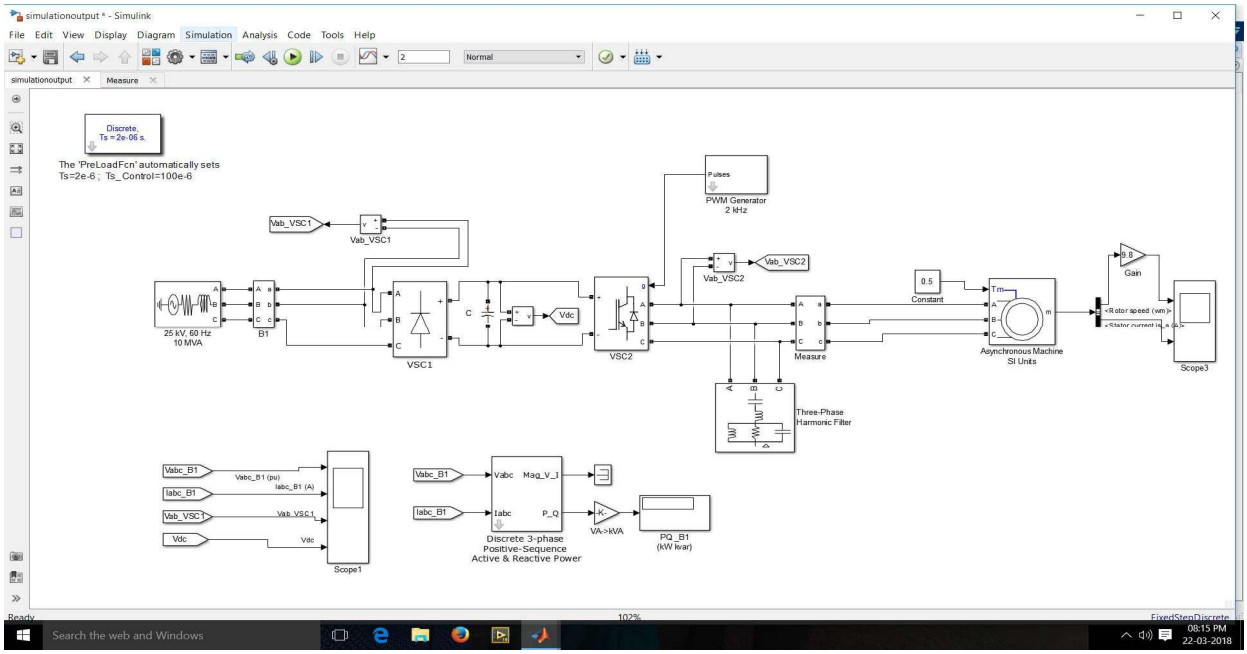


Fig 5: Simulation output with using filter

Fig 6: Hardware connection with using filter

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

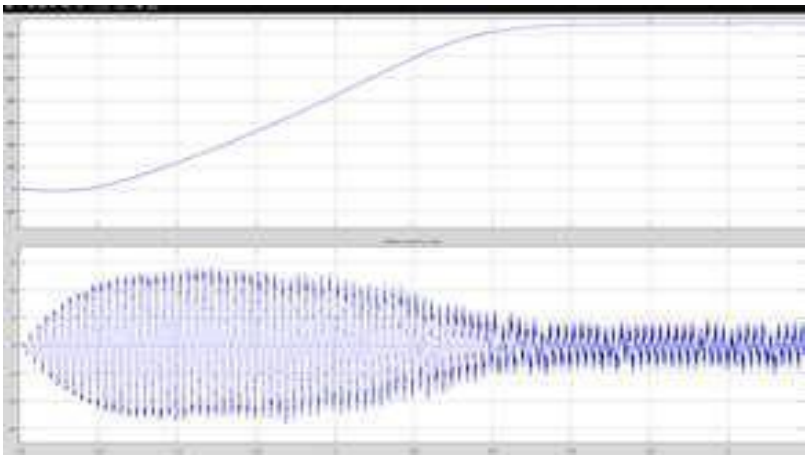


Fig 7: Simulation output for motor performance after connecting filter

V. TOTAL HARMONIC DISTORTION LEVEL

The Fig 8 and 9 shows the percentage of total harmonic distortion before and after connecting filter. The percentage is very much reduced after connecting filter. It reduces from 23% to 5%. This shows that experimentally that Passive filter method will reduce greater amount of harmonics level. Thus, the reduction of harmonics will improve the power quality of the system. It also improves the efficiency of the system

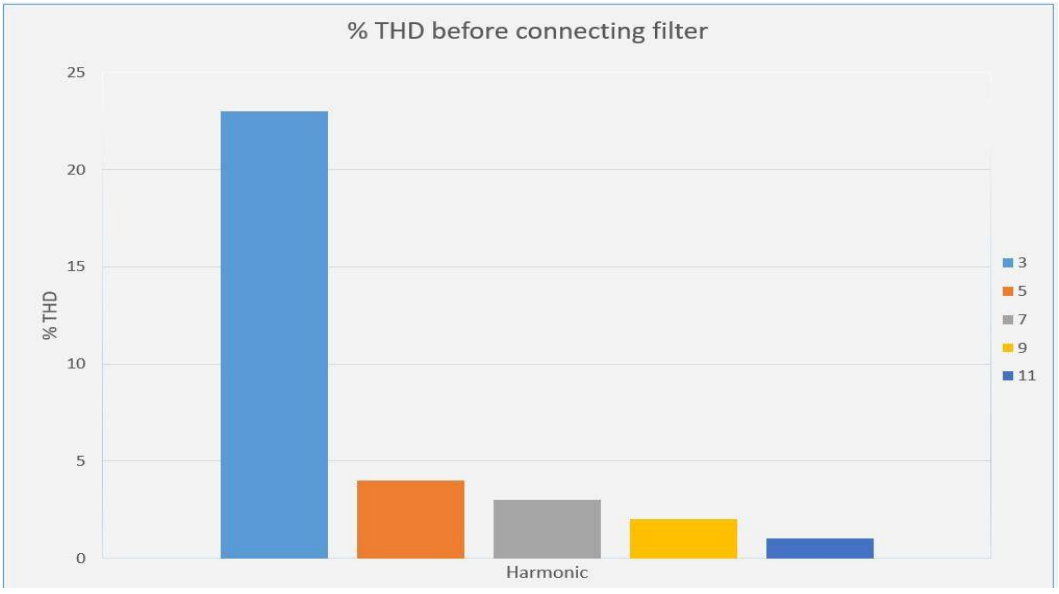


Fig 8: Percentage of THD before connecting filter

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

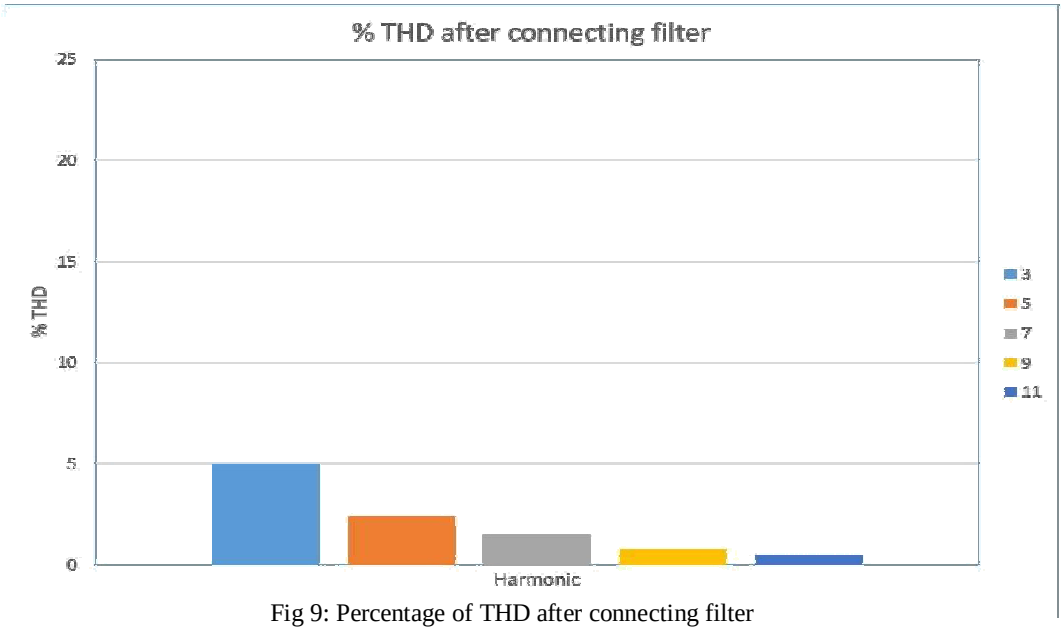


Fig 9: Percentage of THD after connecting filter

VI. CONCLUSION

An ameliorated Passive filter method has been prosperously engendered. The proposed scheme can be acclimated to reduce harmonics in more preponderant percentage. This can be utilized in every industry and can be implementing in daily life due to its less cost and minute size. The L and C filter can be designed according to the system performance. For higher rating machines, higher value of capacitor and inductor is designed. From the simulation analysis it can be found that the proposed Choke filter can provide higher output than expected. As the simulation analysis is done for the inductive load and found to provide the desired output, it can be reliably applied for sundry industrial applications

REFERENCES

1) B. Sing, K.A. Haddad, A Chandra, "Universal Active Power Filter for single -phase reactive power and harmonic compensation," International conference on IEEE Power Quality, pp. 81 -87, 1998.
2) Tain-Syh Luor;" Influence of load characteristics on the applications of passive and active harmonic filters" Harmonics and Quality of Power, 2000. Proceedings. Ninth International Conference on, Volume: 1, 1-4 Oct. 2000 Page(s): 128 -133 vol.1
3) P. Enjeti, P. D. Ziogas, and J. F. Lindsay, "Programmed PWM techniques to eliminate harmonics: A critical evaluation," IEEE Trans. Ind.Applicat., vol. 26, pp. 302–316, Mar. 1990.
4) SIMULINK: The Dynamic System Simulation Software-User's Guide, The MathWorks Inc., April 1993.
5) J. Lai, D. Hurst, and T. Key, "Switch mode power supply power factor improvement via harmonic elimination methods," Record of Applied Power Electronics Conference, Dallas, TX, March 1991.
6) IEEE Emerald Book, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment, IEEE Std 1100-1992.
7) V.Tipsuwanporn, Member,IEEE, W.Thueksathit, and W.Sawaengsinkasikit" Harmonics reduction system using active filter based on computer unit."2005 IEEE/PES Transmission Distribution conference & Exhibition.
8) M.A. Chaudhari, and H. M. Suryawanshi, Member, IEEE " Single-Phase Resonant Converter with Active Power Filter"2006.
9) B. Sing, K.A. Haddad, A Chandra, "Universal Active Power Filter for single -phase reactive power and harmonic compensation," International conference on IEEE Power Quality, pp. 81 -87, 1998.
10) Tain-SyhLuor;" Influence of load characteristics on the applications of passive and active harmonic filters" Harmonics and Quality of Power, 2000. Proceedings. Ninth International Conference on ,Volume: 1 , 1-4 Oct. 2000 Page(s): 128 -133 vol.1
11) P. Enjeti, P. D. Ziogas, and J. F. Lindsay, "Programmed PWM techniques to eliminate harmonics: A critical evaluation," IEEE Trans. Ind.Applicat., vol. 26, pp. 302–316, Mar. 1990.
12) SIMULINK: The Dynamic System Simulation Software-User's Guide, The MathWorks Inc., April 1993.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 3, March 2018

13) IEEE Emerald Book, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment, IEEE Std 1100-1992.
14) R. Zavadil, et al, "Analysis of harmonic distortion levels in commercial buildings, "Proceedings: First International Conference on Power Quality, PQA 1991.
15) MATLAB: High-Performance Numeric Computation andVisualization Software –Reference Guide, The MathWorks Inc., April1993
16) J. Lai, D. Hurst, and T. Key, "Switch mode power supply power factor improvement via harmonicelimination methods," Record of Applied Power Electronics Conference, Dallas, TX, March 1991.