MITIGATION OF HARMONICS USING HYBRID SHUNT ACTIVE POWER FILTER

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Abstract:This project is animated by problems associated with the existence of harmonics in a power supply system. Since the quickgrowth of the semiconductor industry, power electronics devices have obtainedadoration in our day-to-day used electrical house-hold devices. Even if these power electronics appliances have profited the electrical and electronics industry, these appliances are also the principal source of power harmonics in the power system. These power harmonics are called electrical contamination which will reduce the standard of the power supply. As an outcome, filtering procedure for these harmonics is required in order to raise the standard of the power supply. Thus, active power filter appears to be a perfectreplacement for power conditioning to manage the harmonics amount in the power system these days. In this article a union of shunt active filter and a passive filter is used to compensate the THD. (Total order harmonics distortion).

Index Terms–**Active filter, Harmonics, Passive filter, THD (Total order harmonics distortion).**

I.INTRODUCTION

A. FILTERS USED IN POWER SYSTEM

Existence of harmonics has been a lot since the 1990’s and has led to decrease in the standard of power. Harmonics creates due to the non-linear loads.There are some examples of nonlinear loads would beconverters, inverters, etc. There aresome of the examples of electronics equipment’s would be computers, scanners, printers, etc. Some of the mainproblems concerned with harmonics in nonlinear loads are overheating, temperature increase in generators, etc. There is only One way for solving these problemsi.e. the use offilters. Installing a filter for nonlinear loads connected in power system would help in lowering the harmonic effect. With the increase of nonlinear loads in the power system, many filters are needed. Passive filters have been most broadly used to restrict the flow of harmonics currents in distribution systems. The idea of active filter is relatively old, but their practical development was made possible with the new refines in power electronics and microcomputer control strategies as well as with cost reduction in electronic components.Active power filters are becoming a practicable alternative to passive filters and are gaining market share speedily as their cost becomes competitive with the passive variety. Through power electronics, the active filters introduce current or voltage components, which cancel the harmonic components of the nonlinear loads or supply lines respectively.Different active power filters topologies have been introduced and many of them are already available in the market. Due to the non linear loads harmonics are introduced in the system [17]. To reduce the harmonics at the source side hybrid shunt active power filter comes to the picture. By using this shunt hybrid active power filter total harmonics reduction is done in this article.

II.STRATIFICATION OF ACTIVE FILTERS

In many technical literatures different types of active filters have been implemented [1],[2]. Categorization of active filters is made from different angel.They are classified into ac filter and dc filter. Active dc filters have been planned to reduce for current harmonics and/or voltage harmonics on the dc side of converters for HVDC systems [3],[4],[5] and on the dc link of a PWM rectifier/inverter for traction systems [6]. Importance however is put on active ac filters in this article because the term ‘active filters’ mentions to active ac filters in most occurrence.

A. Classification by Objectives: Who is answerable for establishing Active Filters?

The objective of “Who is responsible for installing active filters”classifies them into the following two groups.

1-Active filters installed by individual consumers on their own premises near one or more identified harmonic producing loads.

2-Active filters installed by electric power utilities in substations and/or on distribution feeders.

The principalcause of the active filters installed by individual consumers is to reduce for current harmonic manufacturing loads. At the same time, the keyreason of active filters established by efficacyvery soon is to reduce for voltage harmonics and/or voltage imbalance, or to provide “harmonic damping” throughout power distribution systems. In addition, active filters have the function of harmonic isolation at the utility-consumer point of common coupling in power distribution systems.

B. Stratification by system configuration

1.Shunt Active Filters and Series Active Filters:

The fig1 shows a system arrangement of a shunt active filter.This shunt active filter is one of the most fundamental system configurations. The shunt active filter is connected to draw a compensating current. so that it neutralizes current harmonics on the ac side of a general-purpose thyristor rectifier with a dc link inductor [7],[8] or a PWM rectifier with a dc link capacitor for traction systems [9]. The shunt active filter has the ability of damping harmonic resonance between an existing passive filter and the supply impedance [10],[11**]**.The fig2 shows a system configuration of a series active filter. The series active filter is connected in series with the usefulness through a matching transformer, so that it is applicable to harmonic compensation of a large capacity diode rectifier with a dc link capacitor.

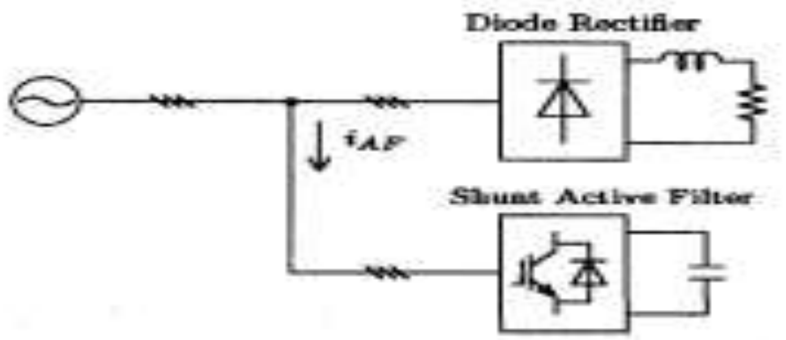


Fig. 1. Shunt active filter used alone.

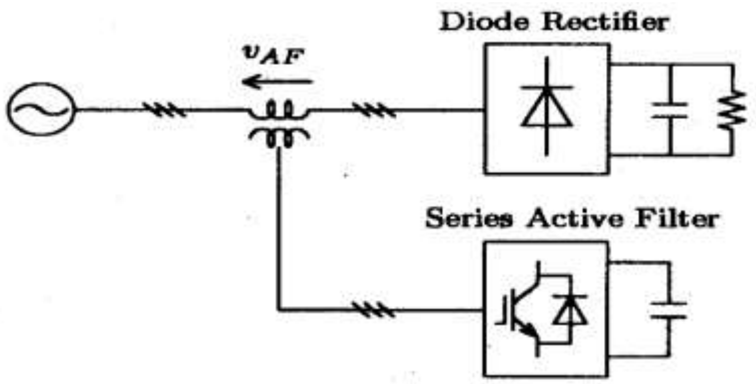


Fig. 2. Series active filter used alone.

2. Hybrid Active/passive Filters:

The figs 3-5 show three types of hybrid active filter and passive filter, the keyreason of which is minimize initial costs and to enhance efficiency. The shunt passive filter be made up of one or more tuned LC filters and/or a high-pass filter. The amalgamation of shunt active filter and passive filter has already been registered to harmonic reduction of huge rated cyclo-converters for steel mill drives [10]. The merged filters are shown in fig4 [12], [13], [14] and in fig5 [15],[16],[17] will be practically applied in the near future, not only for harmonic reduction but also for harmonic isolation between source and load, and for voltage regulation and imbalance reduction. They are considered prospective substitute to shunt or series active filters used alone. Other merged systems of active filters and passive filters or LC circuits have been shown in the figure.

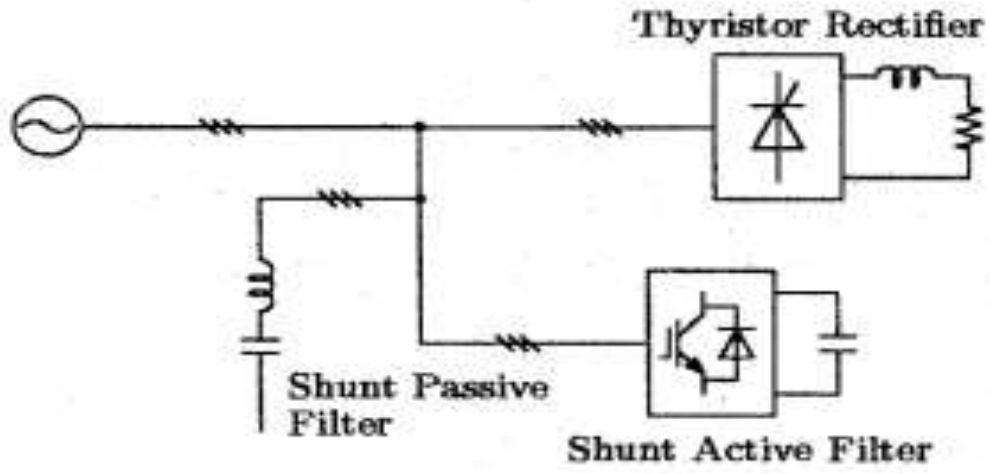


Fig. 3. Combination of shunt active filter and shunt passive filter.

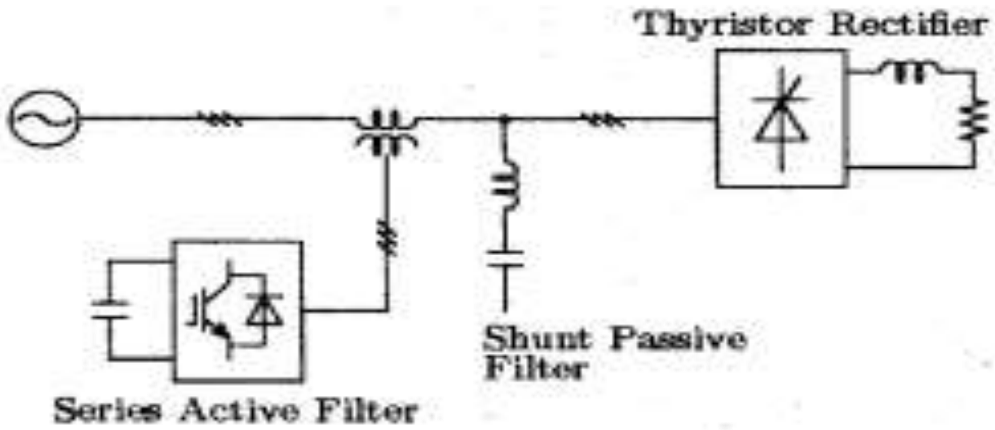


Fig. 4. Combination of series active filter and shunt passive filter.

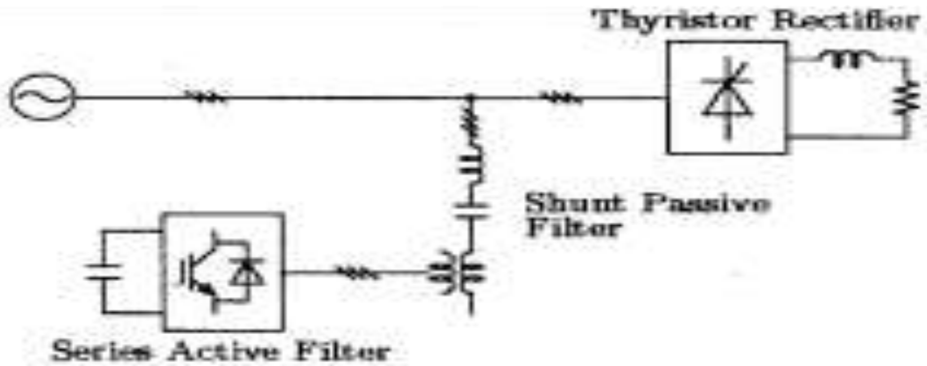
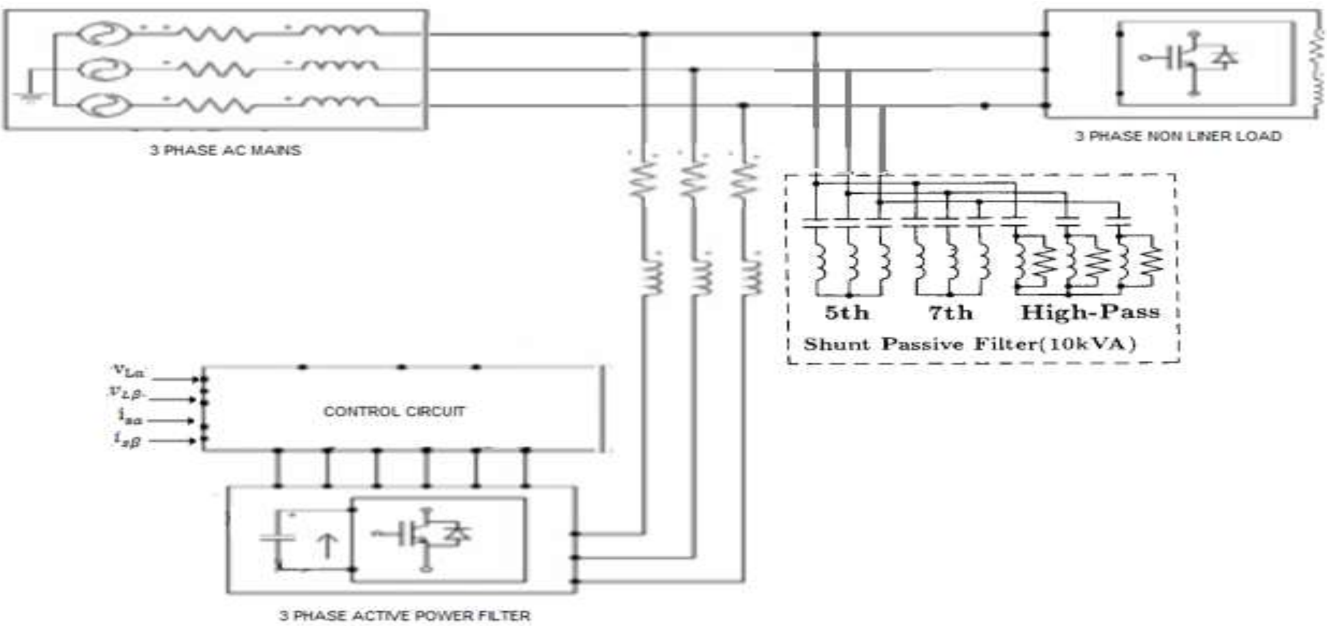


Fig. 5. Active filter connected in series with shunt passive filter.

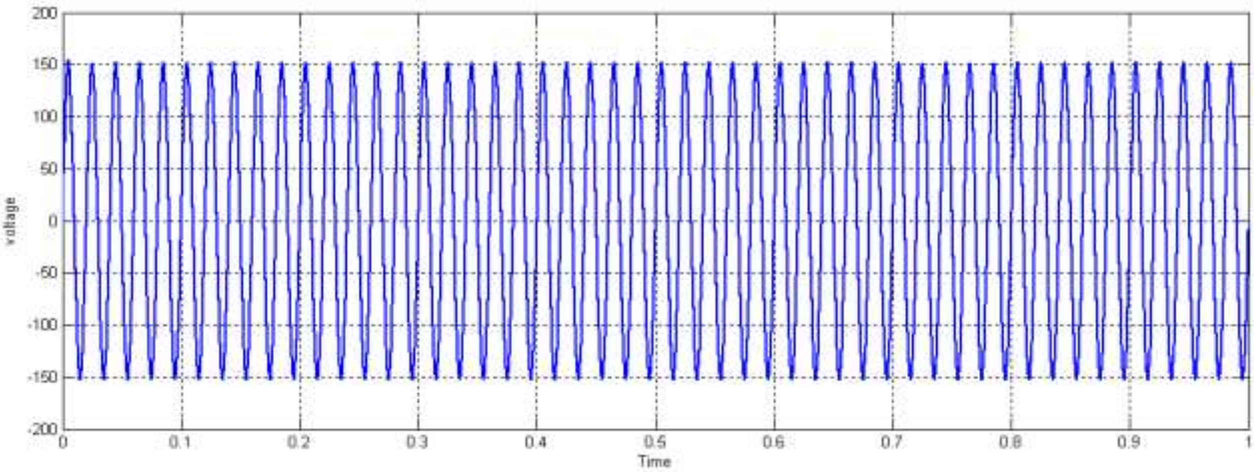
III. System Diagram



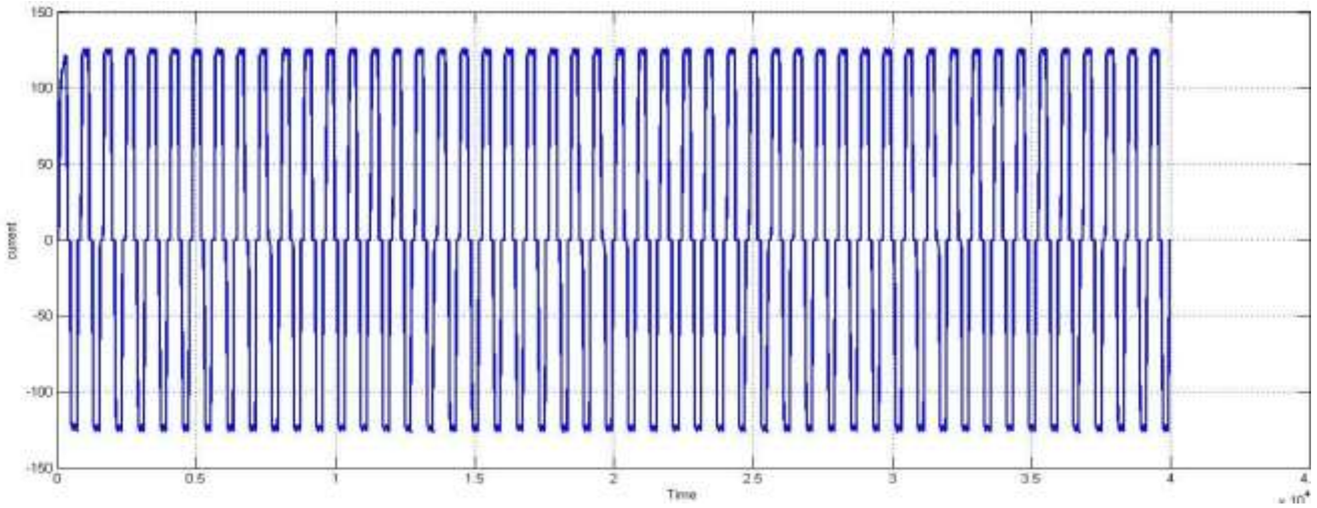
IV.SIMULATION AND RESULT

System parameters	**values**
Supply voltage (Vs)	200v peak
System frequency(f)	50hz
SupplyImpedance (R_s,L_s)	0.1Ω,0.15mh
Filter Impedance (R_F,L_F)	0.1Ω,0.045
Load impedance	2Ω,4mh
Dc link capacitance	500μF

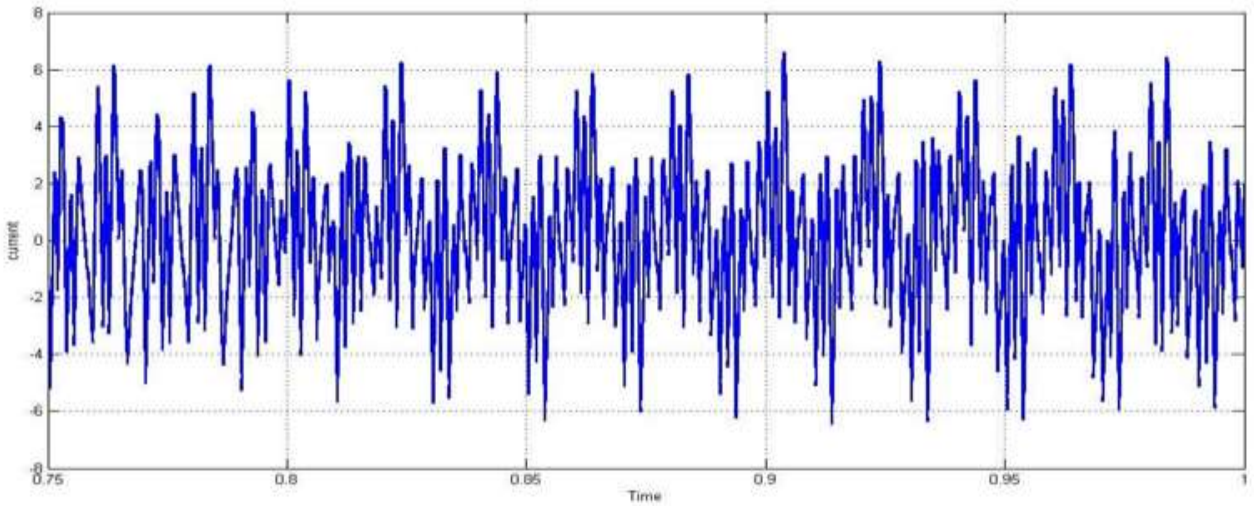
A. Source Voltage:



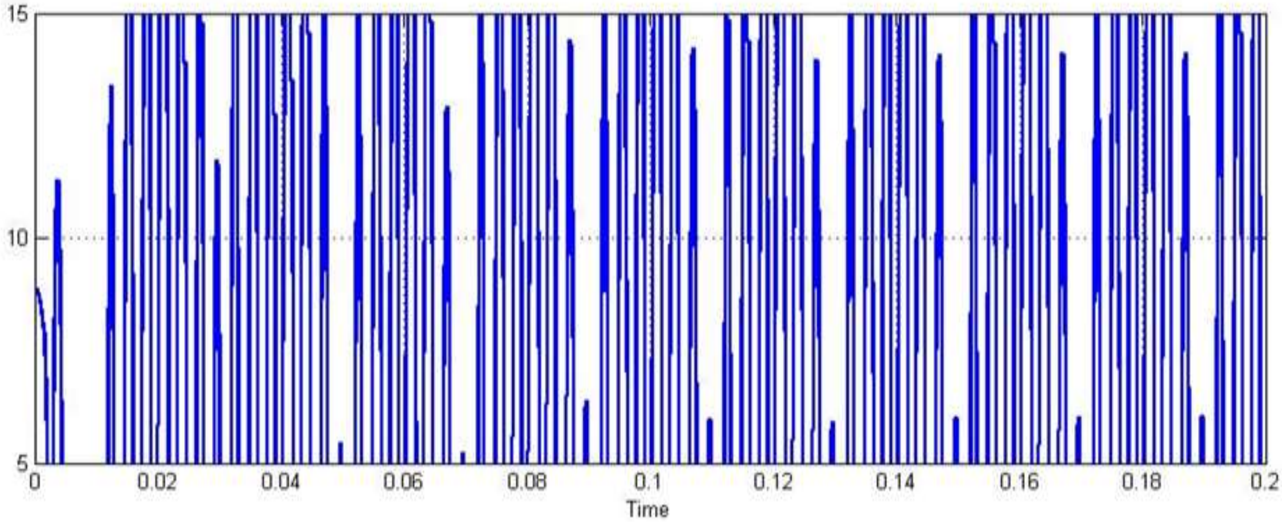
B. Load current:



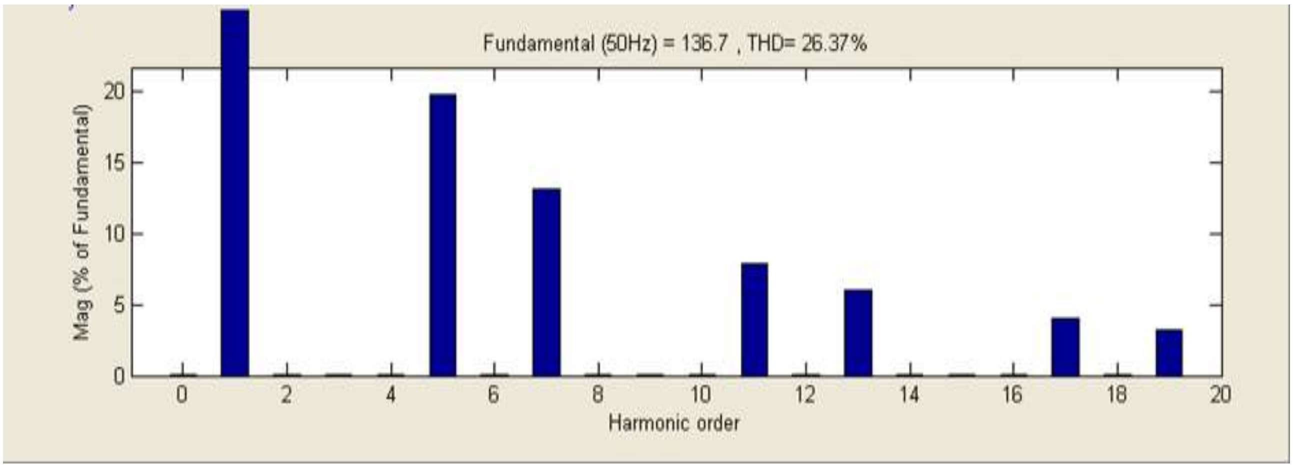
C. Filter current of Active Filter:



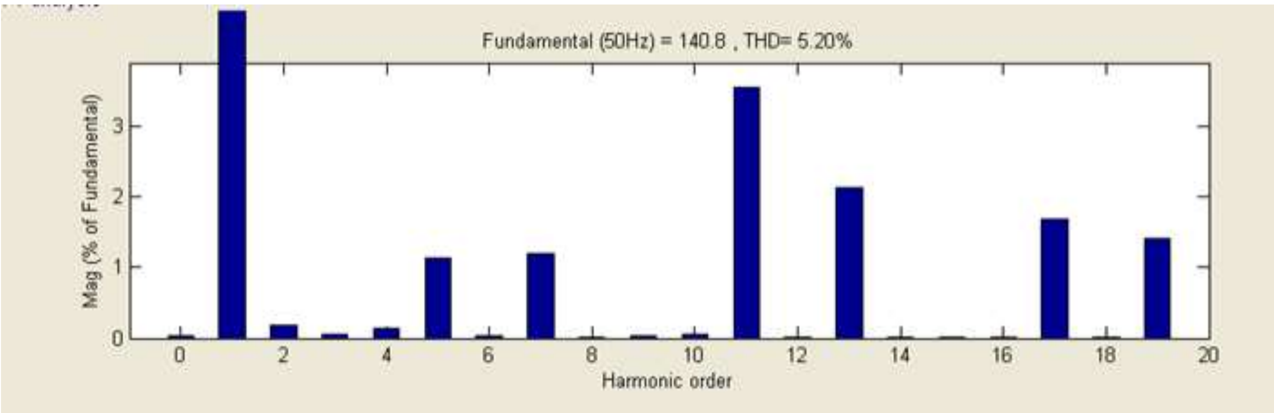
D. Filter current of passive filter:



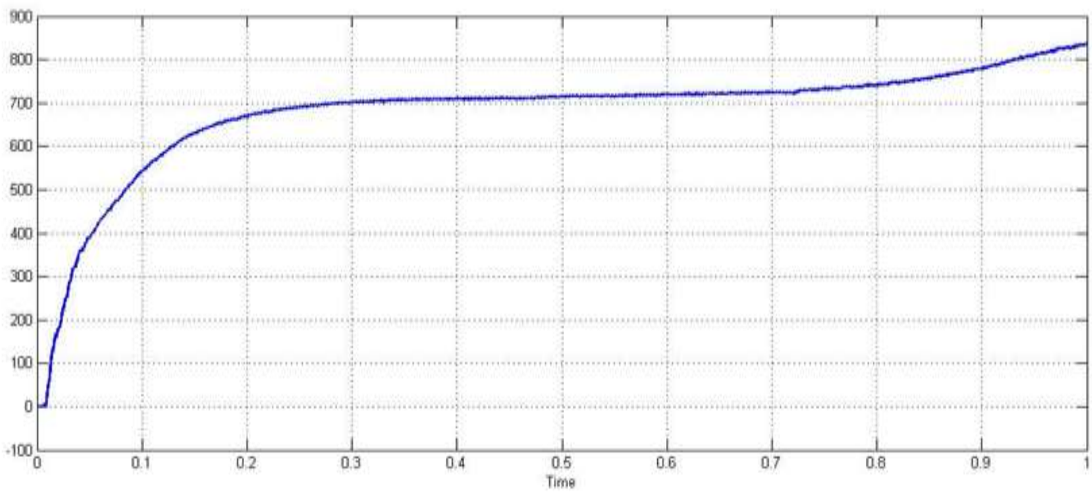
E. Total Harmonic Distortion on Load Side:



F. Total Harmonic Distortion on Source Side:



G. Capacitor Voltage:



V. Conclusion

Reactive power and Harmonicsdemand of non-linear loads become a notableissue for power-quality contamination. Active power filters are theonlyfeasibleclarification to this issue. Forreducingreactive power,harmonics of non-linear loads, I have used a 3-∅ hybrid shunt active power filter in my project.This hybrid active power filter is the combination of a shunt passive filter and a shunt active filter. In this project a mosfet based VSI has been used as shunt active filter and a conjuction of 5^{th}, 7^{th} harmonic filters along with a high pass filter has been used for shunt passive filter configuration. 3-∅ diode bridge rectifiers with R-L load is taken as a non-linear load. To obtain the switching signals, for the active filter have worned Instantaneous power theory. Total THD is reduced from 26.37% to 5.20% from source side and Capacitor voltage stable at 0.4sec.

VI. References

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