International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 01 | Jan -2017 www.irjet.net p-ISSN: 2395-0072

STUDY OF DIFFERENT PASSIVE FILTER- A REVIEW

Rupali B. Ambatkar[1], Ankita P. Bagde[2], Rupali G. Bhure[3], Mr. Bhushan S. Rakhonde[4]

[1] *UG, Electrical Engineering Department, DES'sCOET, Maharashtra, India*
[2] *UG, Electrical Engineering Department, DES'sCOET, Maharashtra, India*
[3] *UG, Electrical Engineering Department, DES'sCOET, Maharashtra, India*
[4] *Assistant Professor, Electrical Engineering Department, DES'sCOET, Maharashtra, India*

Abstract - *This paper presents the different passive filter for harmonic mitigation. The harmonic distortion has become an important subject in Power Quality, especially after the use of power electronic equipment and nonlinear load. Power Quality is a large issue which is becoming increasingly important to electricity consumer. Along with the increasing demand of power quality, the technique that has been used is Passive filter. The Passive Filter consists of series and shunt passive filter. So, Passive Filter can eliminate unwanted harmonics which improve power factor. The passive filters which are required for harmonic mitigation are the single tuned and double tuned harmonic filters. For harmonic mitigation the passive harmonic filter is one of the simple and economical options. In this paper the double tuned filter improves the system performance as compared with single tuned filter.*

Key Words: *Harmonics, single tuned filter, double tuned filter, non linear load.*

1. INTRODUCTION

Basically the common source of harmonic signal is nonlinear load. It is due to the fact that current does not very smoothly with voltage .In present days, wide spread use of nonlinear loads and electronic switched loads as fluorescent lamp, electric welding machine and three phase rectifier has led to the increasing voltage and current harmonic distortions in industrial distribution system and also it generates primarily 5^{th} and 7^{th} current harmonics .These harmonics pollute the power system and produce many adverse effects like malfunction of sensitive equipment, reduced power factor, overloading of capacitor, flickering lights, overheating of equipments, reduced system capacity. Few of the other reported harmonic effect include excessive current in neutral wire, unexplained computer crash. Its more effect can be at distribution grid stations as well as industrial sectors where it causes higher transformer losses, line losses, reactive power and resonance problem, harmonic interaction between customer and the load. To overcome such problem harmonic mitigation is becoming important for both utilities and customers.

The harmonic signal cannot be totally mitigated but it can be reduced by several ways such as by using active filter, passive filter and hybrid filter. The common practice for harmonic mitigation is the installation of passive filter due to many advantages. Passive filters are simplest, no power supply required and exhibit the best relationship cost benefit among all other mitigation techniques when dealing with low and medium voltage rectifier system. They supply reactive power to the system while being highly effective in attenuating harmonic components.

The Passive Filters are used to mitigate power quality problems. More ever apart from the mitigating the current harmonics, the Passive Filters also provide reactive power compensation, thereby further improving the system performance. For current source type of harmonic producing load, generally Passive Shunt Filters are recommended. These filters apart from mitigating the current harmonics also provide limited reactive power compensation and dc bus voltage regulation. However, the performance of Passive Filters depends on source impedance present in the system, as these filters acts as a sinks for the harmonic current.

2. PASSIVE FILTER

Power factor improvement and elimination of harmonics are the primary functions of input filter. In turned circuits, the passive harmonic filters work on the principle of electrical resonance which is useful in mitigation of harmonics.

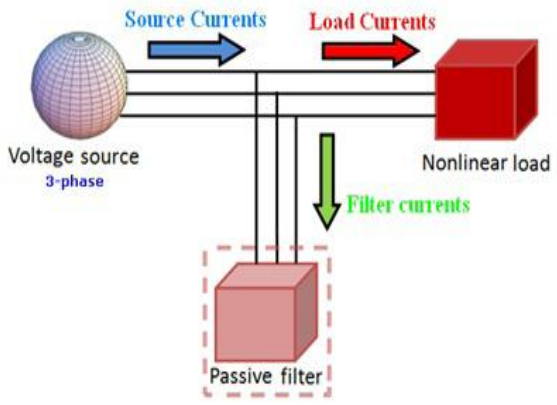

Fig. 1: Basic Configuration of Passive Filter

The passive filter are classified on the basis of type of harmonic generation component source present in the system and are given as passive series filter, passive shunt filter and passive hybrid filter. Again the passive shunt filter are configured as single tuned filter and double tuned filter.

The passive filter is also known to cause resonance, thus affecting stability of the power distribution.

3. SINGLE TUNED PASSIVE FILTER

Most common type of filter which is used in industry broadly for harmonic mitigation is single tuned passive filter. This type of filter is simplest and inexpensive for the mitigation of harmonic problems as compared with the other filters. Single tuned filters are more effective to suppress harmonics of selected frequency.

It mainly consists of series connection of resistance, inductance and capacitance. This series connection is connected in parallel with the non linear load which is shown in Fig. 2

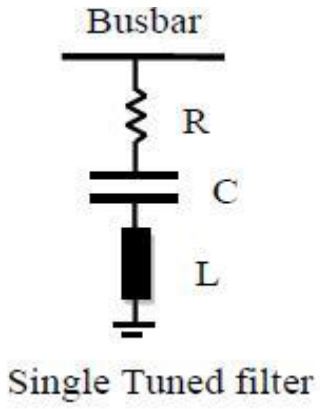

Fig. 2: Single Tuned Filter

At the resonance condition, it can be tuned to lower order harmonics. As the tuning is difficult in case of higher order harmonics. Hence these types of filter are not useful for higher order harmonics. When the resonance occurs the inductive reactance will be equal to the capacitive reactance. So that the total impedance of the system becomes less which provides the low impedance path to that of the particular resonance frequency which eliminates the harmonics due to nonlinear loads. Which result in improving the power factor. The circuit becomes capacitive when the frequency is less than resonance frequency and if it is more than resonance frequency the circuit becomes inductive in nature. The resonant frequency for the single tuned filter is given by the following equation.

$$f_0 = \frac{1}{2\pi\sqrt{lc}} \qquad (1)$$

Where,

Fo is frequency at resonant in Hz

L is inductance of filter in Henry

C is capacitance of filter in Farad.

4. DOUBLE TUNED PASSIVE FILTER

The combination of series and parallel connection of passive element forms the double tuned filter. It has the advantage that is to reduce the power loss at fundamental frequency and is recommended for higher voltage application. The schematic diagram of double tuned passive filter is shown in Fig. 3

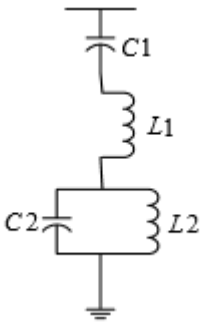

Fig. 3: Double Tuned Passive Filter

The work of this filter is used to filter two harmonic component simultaneously means the double tuned filter consist of two desperate parallel circuits. The one resonance frequency given from series circuit and another resonant frequency is given from parallel circuit.

5. DISCUSSION

We discussed about the types of passive shunt filter that is single tuned passive filter and double tuned filter. As a result the double tuned filter eliminates more harmonics with respect to the single tuned filter.

6. CONCLUSION

From the given study on passive filter, the performance of double tuned filter is better than that of single turned filter. In double tuned filter the elimination of harmonics is more compared to single tuned filter. Hence improves the performance of system.

REFERENCES

[1] D. Maheswaran, N. Rajasekar, Ashok kumar, "Design Of Passive Filters for Reducing Harmonic Distortion And Correcting Power Factor Two Pulse Rectifier Systems Using Optimization", *Journal of Theoretical and Applied Information Technology* 30th April 2014. Vol. 62 No.3, pp. 720-728.

[2] S. N. AL. Yousif, M. Z. C. Wanik, "*Implementation of Different Passive Filter Designs for Harmonic Mitigation*",

National Power & Energy Conference 2004 Proceedings, Kuala Lumpur, Malaysia, pp. 229-234.

[3] D. M. Soomro and M. M. Almelian, "Optimal Design of A Single Tuned Passive Filter to Mitigate Harmonics in Power Frequency", *APRN Journal of Engineering and Applied Sciences,* Vol. 10, No. 19, October 2015, pp. 229-234.

[4] H. Prasad1, M. Chilambarasan, T. D. Sudhakar, "Application of Passive harmonicFilters to Mitigate Source Side Current Harmonics in an AC – DC - DC system", *International Journal of Research in Engineering and Technology*Vol. 03 Jan-2014.