SSRG International Journal of Electrical and Electronics Engineering (SSRG-IJEEE) – volume1 issue 5 July 2014

Compensation of Source Current Harmonics Using Shunt Active Filters

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ABSTRACT:

In the recent time we have been notifying a big change in the use of non-linear loads. Due to this the value of harmonic non-sinusoidal currents and voltages have also increased upto a greate extent in the system. These harmonic elements effect the overall power system as well as the client's equipments also. So today the issue of maintaining the power quality is a big issue. In the recent times active power filters have been proposed as efficient for power quality improvement and reactive power compensation. In this paper we have discussed all the problems relating to the harmonics and how to eliminate them using SAPF.

Keywords- Active Power Filter, Instantaneous Power Theory, Self-Tuning Filter, Harmonics, Non Linear Load.

I. INTRODUCTION

The use of nonlinear loads is increasing tremeandously day by day. This is an overhaul to the increase of harmonic currents to a great extent. The researchers were encouraged with the advancement in the power electronic industry and got an efficient tool to tackle these kind of harmonic problems. Shunt active power filters are such a mean to get the harmonics eliminated from the over all system.

Many types of APF have been proposed and used in harmonic compensation. Series APF is used for voltage harmonics compensation. Shunt APF was proposed for current harmonics and reactive power compensation. The Unified Power Quality Filter or Conditioner combines the two types Shunt and Series APF in one device responsible for the simultaneous compensation of voltage, current harmonics and reactive power. Different combinations of APFs with passive filters have been also used and proposed in the literary in the so-called Hybrid APFs (HAPFs). The combination between the traditional and the modern in one HAPF has the aim of amelioration of different types of APF compensation performance, also the minimization of cost and complexity of compensation systems. It is considered to combine the advantages of old passive filter and the new APFs and reject the drawbacks related to each of them when used individually.

I. SIMULATION AND RESULTS

The use of a shunt active harmonic filter (AHF) to minimize the harmonic content propagated to the source from a non-linear load is shown below using matlab Simulink. After going through the results we find that the shunt active power filters are very helpful in reducing the harmonic voltages and currents in the system.

The shunt APF has been used for compensating the source current harmonics and it reduces the source current THD from 21.83 % to 0.42 % for RL load and from 25.43 % to 2.03 % for DC machine load which shows that the quality of source current improves sharply.

II. FIGURES AND TABLES

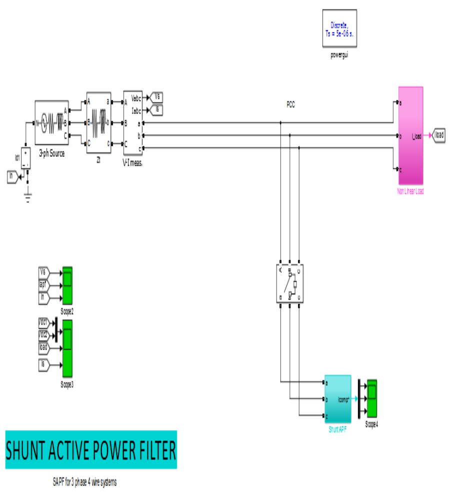

Figure.1 Network without Shunt Active Filter

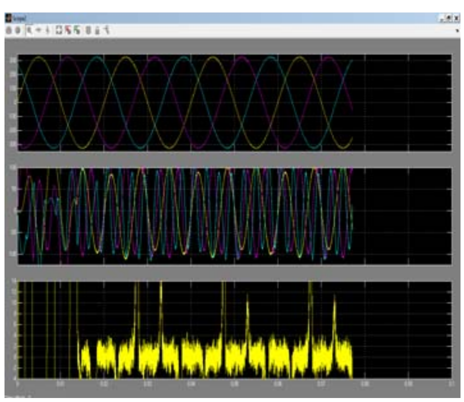

Figure.2 Source voltage and neutral load current before

compensation

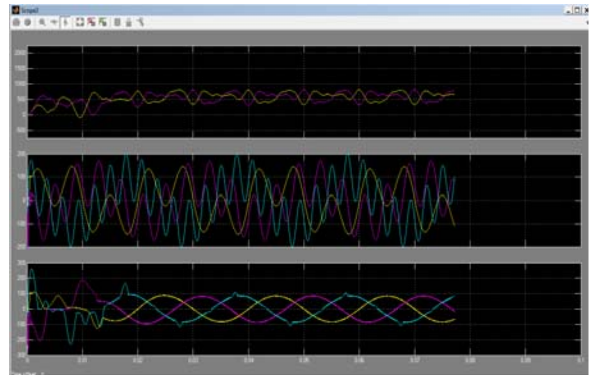

Figure.3 Uncompensated V_{dc1}, V_{dc2}, load current and source current

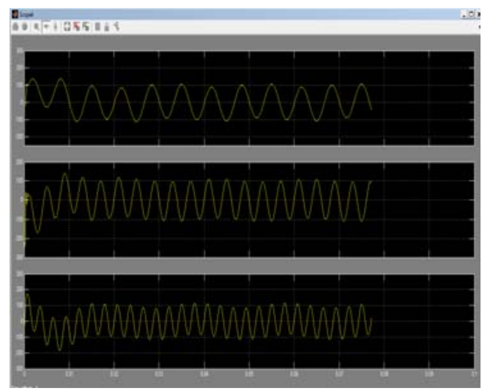

Figure.4 I_{comp} at the o/p of shunt active filter still not applied to the network

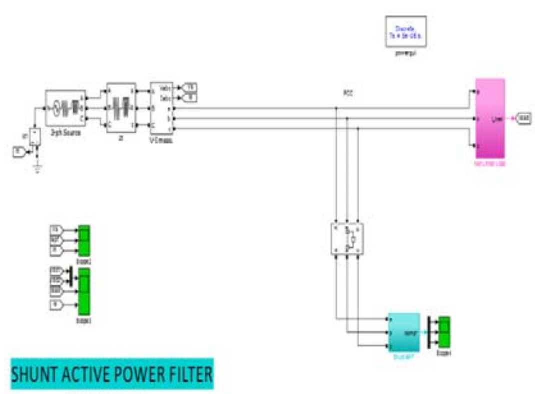

Figure.5Network with shunt active filter enabled

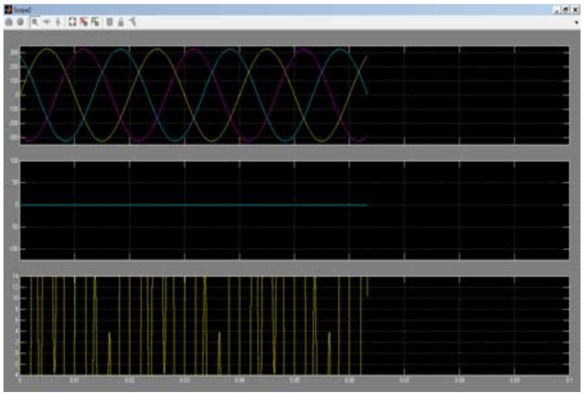

Figure.6 Source voltage and neutral load current after compensation

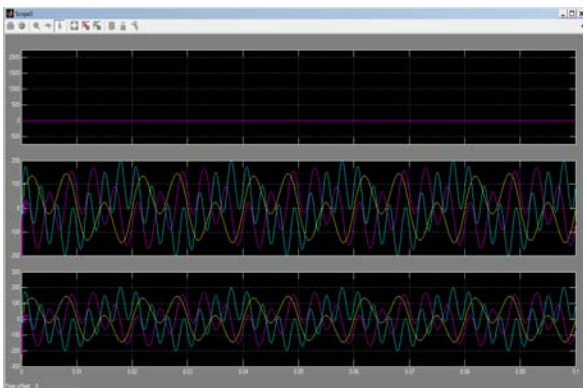

Figure.7 Compensated V_{dc1}, V_{dc2}

III. CONCLUSION

The simulation results show that shunt apf, series apf can be used for effectively improving the power quality of an electrical power system. The shunt apf has been used for compensating the source current harmonics and it reduces the source current thd from 21.83 % to 0.42 % for rl load and from 25.43 % to 2.03 % for dc machine load which shows that the quality of source current improves sharply

IV. FUTURE SCOPE

In high power applications, the filtering task cannot be performed for the whole spectrum of harmonics by using a single converter due to the limitations on switching frequency and power rating of the semiconductor devices. Therefore, compensating the reactive harmonic components to improve the power quality of the DG integrated system as well as to avoid the large capacity centralized APF, parallel operation of multiple low power APF units are increasing. Like APF, UPQC can also be placed at the PCC or at a high voltage distribution line as a part of DG integrated network or in micro grid system to work both in interconnected or islanded mode. At this place, capacity enhancement is achieved by using Multi-level topologies to reach the higher power levels. These option s are as follows:

i. Multi-level converter based UPQC
ii. Multi-module converter based UPQC
iii. Multi-module (power cell) unit based UPQC

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