International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 02, February-2019

A Review on Passive Shunt Filter TCR and TSC Combination for Power Quality Improvement

Pradeep Patel[1], Rakeshwari Agrawal[2]

[1]*M. Tech Scholar (P.E.),Trinity Institute of Technology, Bhopal (M.P.)*
[2]*Professor (Ex. Dept.),Trinity Institute of Technology, Bhopal (M.P.)*

Abstract— This paper highlights the Reactive power and harmonics problems which is created by voltage and current fluctuations in power system. The harmonic problem causes the effects of equipment damage and Electromagnetic Interference effects in the power system. The expanded hardness of harmonic pollution in power system has attracted the concentration of system engineers to develop a powerful solution to the power quality problems. These equipments known as Passive Shunt filter (PSF's). To reduce this problem Passive Shunt filter has more suitable because of its excellent performance of harmonic mitigation, In this paper Passive Shunt filter TCR & TSC Combination for Power Quality Improvement method is presented and discussed, The simulation result of Passive Sshunt filter usingTCR & TSC Combination Scheme is carried out using MATLAB/SIMULINK toolbox.

Keywords— PSF, TCR,TSC, PQ, MATLAB.

I. INTRODUCTION

Harmonics and reactive power regulation and guidelines are forthcoming issues and more and more being adopted in distributed power system. Fundamental use of power electronic appliances has made power organization smart, flexible and efficient. But alongside they are important to power pollution due to injection of current and voltage harmonics. Harmonic creates problems in the incorporated power systems. The researchers have started giving effort to apply harmonic rules throughout guidelines of IEEE 519 - 1992. Instantly customers have to pay and avail the facility for high performance, high efficiency, and compact power electronics technology. This is only possible by the regular efforts of power system engineer's will make good feasible to suck up the increased cost for solving the harmonic pollution in the system.

The thyristor controlled reactors of various network configurations are broadly used in industries for harmonic mitigation and active power factor improvement. This thyristor controlled reactor operate as a changeable reactance in equally the inductive and capacitive domains. As a result of these parameter two problems are generally encounter in the power system. The main sources of harmonics generation are electric machines, fluctuating industrial loads, such as electric arc furnaces, rolling mills, power converters etc. These types of heavy industrial loads are usually rigorous in one plant and served from one network terminal, and consequently, can be handled best by a local compensator associated to the similar workstation.

The main prominence of the study has been on compactness of configurations, simplicity in power, reduction in rating of components, therefore finally leading to discount in overall cost. Based on these considerations, a broad range of configurations of power quality mitigators are industrial for provided that a complete exposure to the design engineer into selection of a particular configuration for an explicit application under the given constraints of financial system, and the preferred performance.

This paper presents design, simulation, and development of passive shunt filter and TCR & TSC combination for mitigation of the power quality problem at ac mains. Harmonics in the Power system causes a serious damage to electric equipments and heavy machines. The line current harmonics reason raise in losses, insecurity, and voltage distortion. With the sudden increase in the quantity of non linear loads in power lines have become highly polluted. Mainly Passive and active filters generaly used just near loads which are producing current harmonics. Shunt filters still have a lot of influence over the harmonic compensation at fluctuating load in the power system. With various applications linking reactive power jointly with harmonic compensation, passive filters are found suitable. Passive filters having an effective solutions for harmonic pollution recompense in distributed power systems. This type of filters are tuned to satisfy certain harmonics there in line current.

The uncontrolled type of ac-dc converter suffers as of working troubles of poor power factor, insertion of harmonics put in ac supply, apparatus overheating owing to harmonic current incorporation and voltage distortion due to the voltage fall caused by harmonic currents flowing throughout system impedances, interference on telephone etc.

The main importance of this techenique has been on a compactness of simplicity in control, and reduction in rating of components. Thus it finally leads to saving in overall cost. Based on these type of considerations, a broad variety of configurations of power quality mitigators are urbanized, which were expected to offer complete exposure for design engineers to select an exacting configuration for an exact function below the given constraints of financial system and desired performance. This type of filters are comprehensively used to reduces the pollution of harmonics. The

combinations of passive filters with TCR and TSC be as well designed and analyzed to get better the power quality at ac mains.

Power quality:

Institute of Electrical and Electronic Engineers (IEEE) Standard IEEE1100 defines power quality as "the concept of powering and grounding sensitive electronic equipment in a manner suitable for the equipment." As appropriate as this explanation might appear, the constraint of power quality to "responsive electronic equipment" may be subject to disagreement. Electrical tools liable to power quality or more suitably to lack of power quality would drop within a apparently boundless area. The entire electrical devices are prone to failure or malfunction while uncovered to one or further power quality problems. These electrical apparatus might be an electric motor, a transformer, a computer, a printer, communication equipment, or a household appliance. All of these type of devices and others respond harmfully to power quality issues, depending on the rigorousness of problems. A simpler and conceivably more brief definition may state: "Power quality is a set of electrical limitations that allows a piece of apparatus to function in its planned manner without considerable loss of performance or life suspense." This definition embraces two thing that we require from an electrical device: performance and life expectancy.

Power Quality Disturbances are as follows:

Under Voltage:

There are many type reasons for the under voltage situation inside the power system. When reduce in the rms ac voltage to less than 90% of a power system for several amount of time after that under voltage provision exists. Load switching on or a Capacitor bank switching off can also cause under voltage condition. Furthermore, when the power system is overloaded it might be result into under voltage situation. Because of under voltage, equipments that require constant steady state voltage will not work properly and also system voltage regulation will takes place.

Over Voltage:

Compared to the under voltage, over voltage is an increase in the rms ac voltage to greater than 110% of a power system for some amount of time. Switching off a large load or energizing a Capacitor bank can cause over voltage. Equipments will not work properly because of over voltage.

Harmonics:

Harmonics are caused by Non-linear loads such as Semiconductors and Saturated Inductances. Because of Harmonics Transformers, AC Motors, Capacitor banks, Cables, Protective devices and Sensitive equipments will not operate properly. Telephone Interference is also the effect of Harmonic. Harmonics reason deformation in current and voltage waveforms resultant into deterioration of the power system. A uncontaminated sinusoidal waveform through zero harmonic distortion is a theoretical magnitude and not a practical one. The voltage waveform, still at the point of generation, contains a tiny amount of distortion due to no equality in the excitation magnetic field and distinct spatial division of coils about the generator stator slots. At the point of generation harmonics is usually very low, normally less than 1.0%. The generated voltage is transmitted many hundreds of miles, transformed to several levels, and ultimately distributed to the power user. The consumer equipment generates currents so as to are rich within harmonic frequency components, specially in huge commercial or industrialized installations. As harmonic currents travel to the power source, the current distortion results in additional voltage distortion due to impedance voltages associated with the various power distribution equipments, such as transformers, cables, buses, and so on. Stationary uninterruptible power source (UPS)can generate substantial voltage distortion owing to the nature of their action.

II. PROPOSED METHODOLOGY

This Paper presents a passive shunt filter with the combination of TCR-TSC based on matlab/simulink to suppress the harmonics due to non linear loads and for the compensation of the reactive power so as to improve the power quality. The essential modeling and simulations are carried out in MATLAB environment by means of SIMULINK.

III. EXPECTED RESULTS

The main objective is to study different methods for the mitigation of the harmonics due to non linear loads and to design, modeling and simulation of AC-DC converter connected to an R-L load using a passive filter with thyristor controlled reactor (TCR) and thyristor switched capacitor (TSC) for reactive power compensation and suppression of harmonics.

IV. CONCLUSION & FUTURE SCOPE

CONCLUSION

The Passive Shunt Filter with TCR-TSC Combination improves the Power Quality parameters, such as harmonic current and reactive power due to non-linear load. The performance of Passive Shunt Filter with TCR-TSC Combination is verified with the simulation results. Hence, we obtained comparative results by using the Passive Shunt Filter alone and with the combination of TCR-TSC.

SCOPE FOR THE FUTURE WORK

The scope of this work includes power quality improvement at ac mains in ac-dc power supply feeding to a nonlinear load with the objective function of harmonics minimization. MATLAB i.e. the matrix laboratory is the software used, and is now widely used for the simulation for almost all type of power systems. The main emphasis of the work is to resolve the issue of harmonics and reactive power by using filters, with the combination of TCR-TSC in the power system. By installing a filter for nonlinear loads connected in power system harmonic effects would be reduced.

REFERENCES

[1] D. Rivas, L. Morán, J. Dixon, and J. Espinoza, "A simple control scheme for hybrid active power filter," in *IEEE Trans.*, pp. 991–996, June 2000.
[2] D.J. Hanson, M. L. Woodhouse, C. Horwill, D. R. Monkhouse, and M. M. Osborne, A new area for compensation of reactive power," *Power Engineering Journal*, pp. 151- 160, Jun. 2002.
[3] E. Hammad and M. El-Sadek, "Thyristor based controlled VAR Comperator for damping Oscillations in the Power Systems," Vol. PAS-103, pp. 198-212, 1984.
[4] E. R. Ribeiro, and I. "Reduction of Harmonics with the help of a series active filter in various conditions," *IEEE Transactions on Power Electronics*, vol. 21, no. 5, pp. 1394-1402, Sep. 2006.
[5] F. J. Peng, and H. Akagi, "Compensation characteristics of the combined system of shunt passive and series active filters," *IEEE Transactions on manufacturing Applications*, vol. 29, no. 1, pp. 144-152, Feb. 1993.
[6] F. Z. Peng, "Harmonic sources and filtering approaches," *IEEE Trans. on Industrial Appications.*, vol. 7, no. 4, pp. 18–25, Jul./Aug. 2001.
[7] F. Z. Peng, G. J. Su and George Farquharson, "A series LC filter for harmonic compensation of AC drives," in *Proc. of the IEEE* , vol. 1, pp. 213- 218, June/July 1999.
[8] F.Z. Peng, H. Akagi, A. Nabae, "Compensation characteristics of combined system of Shunt Passive and Series Active Filters", *IEEE Trans.*, pp 959- 966, 1989.