Advanced Research in Electrical and Electronic Engineering
Print ISSN: 2349-5804; Online ISSN: 2349-5812 Volume 2, Number 9 April-June (2015) pp. 63-66

http://www.krishisanskriti.org/areee.html

A Modeling and Simulation of Low Cost Power Factor Improvement Technique by Using Modified Filter

Preeti[1] and Vijay Garg[2]

[1,2]*M.Tech, Department of Electrical Engineering, UIET, Kurukshetra University, Kurukshetra, India*
E-mail: [1]preeticanwaleee@gmail.com, [2]vkgarg_kuk@yahoo.com

Abstract—*This paper presents a low cost power factor improvement technique. It is based on FACTS technology. This control scheme is designed for power factor improvement as well as power quality enchantment like THD, reactive power compensation etc. it also to improve energy utilization using a Low-Cost power factor improvement technique with PWM and filter control by a tri-loop Dynamic Error driven error regulator. It is connected with hybrid load including linearized, motorized and nonlinear type loads. The main aim of this paper is to study the comparative simulating results of the conventional method and purposed technique. The FACTS filter compensation scheme has been fully validated for harmonic reduction and power factor correction using the Matlab Simulink software environment. This scheme is applicable for domestic, industrial as well as commercial area.*

Keywords*: Distribution system, linear load, nonlinear load, motorized load, RLC filter, tri loop error control technique.*

1. INTRODUCTION

In the electrical system like industrial, commercial & domestic area the efficiency of the system is depends upon power factor of the load. The low power factor of the system effects on transmission line, transformers etc. It decreases the performance of the whole system. It's findingthat if the power plant work on poor power factor it effect economic factor of any system. Due to poor power factor the capital cost of any plant is increased. As well as the generation, transmission and distribution systems cost is also increased. It means that higher the capital charges than higher the annual fixed charge of the system. That will increase per unit cost of the electricity. So that if the power factor of system is high it's good for both the consumers and the suppliers. That why the suppliermotivate the peopleto work on improved power factors. The power factor is the ratio of active power (kW) to apparent power (kVA) of any A.C. system. It is also the cosine of the angle between voltage and current[9-10].

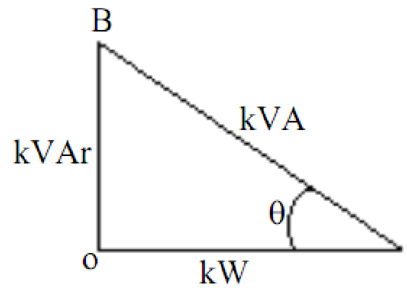

Fig. . 1: Power factor triangle

the relationship active power(kW) and apparent power(kVA) as shown in Fig. . 1.

P.F. = Active Power/Apparent Power

P.F=kW /kVA

Generally the power factor can be improved by using capacitor bank and synchronous condenser but it is not effective in casestable power factor improvement. Now a day power factor can be improved by using filter, converters, active filters and facts devices also.All of these devices connected across the load like capacitor bank. So that's why we used the FACT devices for improvement of power quality. But its construction is complicated. This is expensive for small system. So that to remove these entire drawback we used the simple RLC filter. It is modulated as like a FACT device and it's also works as fact devices. It is also called modulated filter[1-4].

2. SYSTEM DESCRIPTION

The Fig. . 2 shows the sample study voltage transmission-distribution system using the 3 phases 3 wires for residential buildings, commercial load

centersand industrial. It is with nonlinear and linear loads. At these load condition power factor is low. For improvement we connected the power filter across the load as shown in Fig. -3

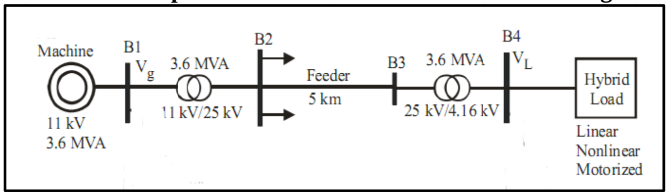

Fig. 2: 3 phase system without filter

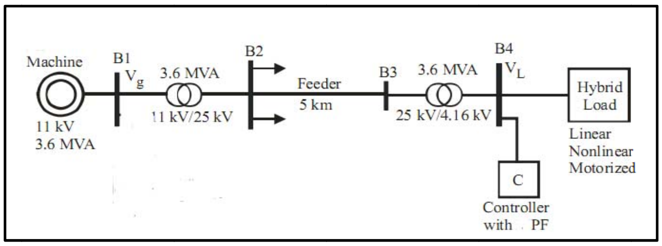

Fig. 3: 3 phase system with filter

3. CONTROL STRATEGY

The load voltage and load current are controlled with a tri-loop error control technique. These tri-loop error control technique calculate the errors of RMS load voltage and, RMS load current and transmitted power in the system as shown in Fig. . 6.

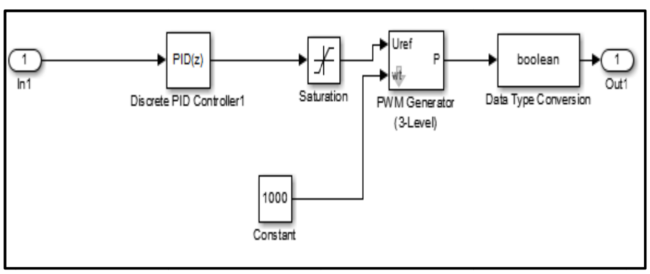

Fig. 4: Controller

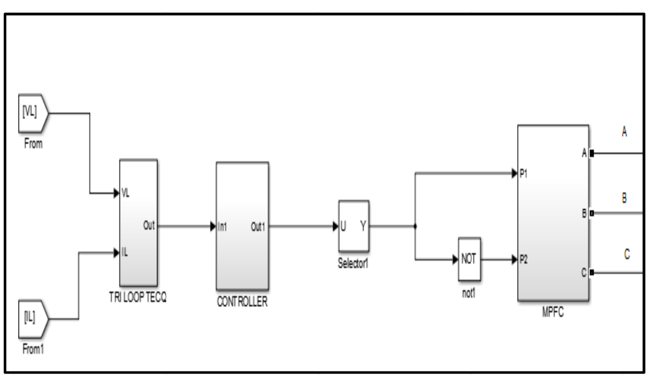

Fig. 5: Block of controlling scheme

These three loops, is used for improve power factor, improve reactive and apparent power and also reduce THD. So that it improve the overall efficiency of the system.

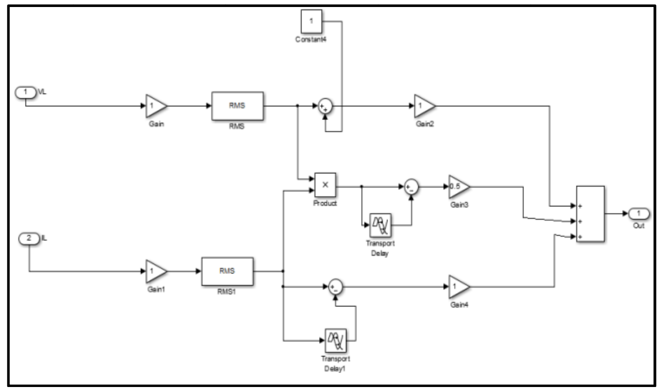

Fig. 6: Tri loop error control technique

Loop 1 is used as like a main loop for the steady state error of the RMS Load voltage on the load side and this control signal weight (γV) is 1.

Loop 2 is used for the steady state error of the RMS load current on load side and its weight (γI) is 0.5.

Loop 3 is used for the steady state error for power and the weight (γP) is 1.

The total error signal of the tri-loops is passed through a PID controller for the angle order and it is converted into degrees. Than this phase order is given to discrete PWM generator through saturation and firing circuit to arrange the sequences of ideal switches. This tri-loop error controller is used for power factor improvement, reduce the distortion and reactive compensation using Matlab-Simulink and Sim-Power Toolbox software environment.[5-8]

4. DIGITAL SIMULATION RESULTS AND DISCUSSION

The Matlab/Simulink/Sim-power digital simulation of the sample study system model at load condition and improve the results with modulated filter scheme and thisresult is compare with capacitor bank connected system Fully digitalSimulation results and simulation diagram are shown in Fig. . 7 to Fig. . 15.

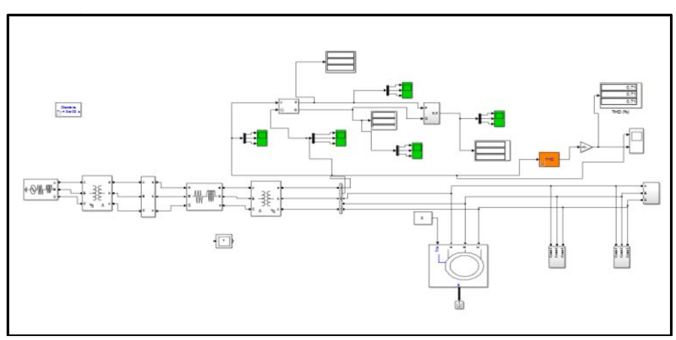

Fig. 7: Simulation Modal

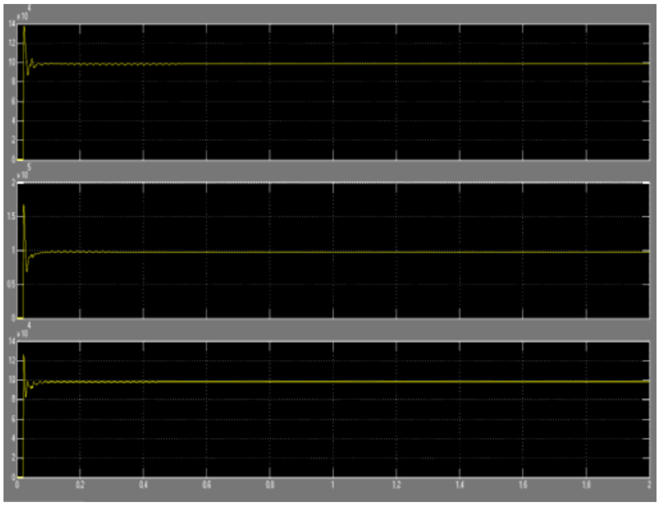

Fig. 8: Active power without filter

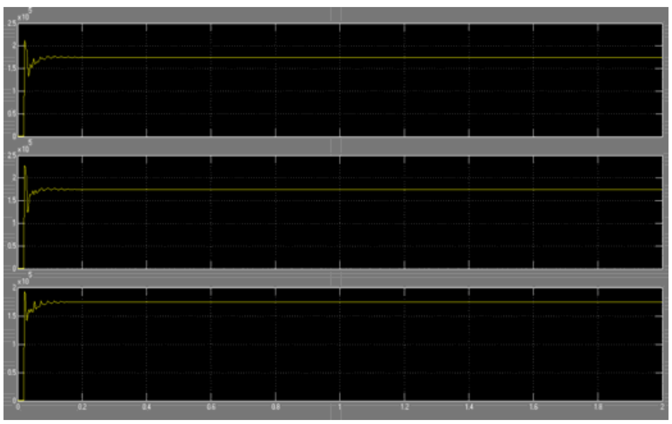

Fig. 9: Active power with filter

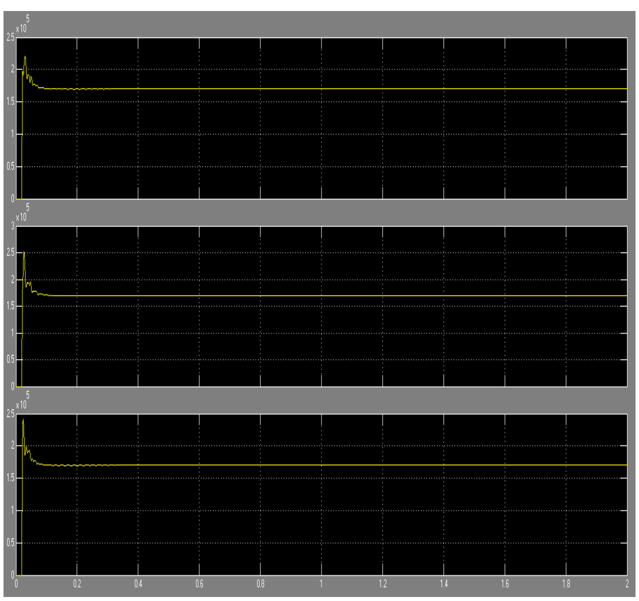

Fig. 10: Reactive power without filter

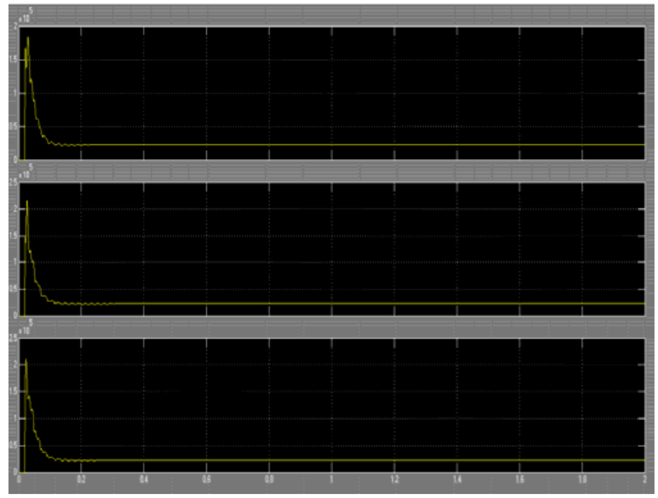

Fig. 11: Reactive power with filter

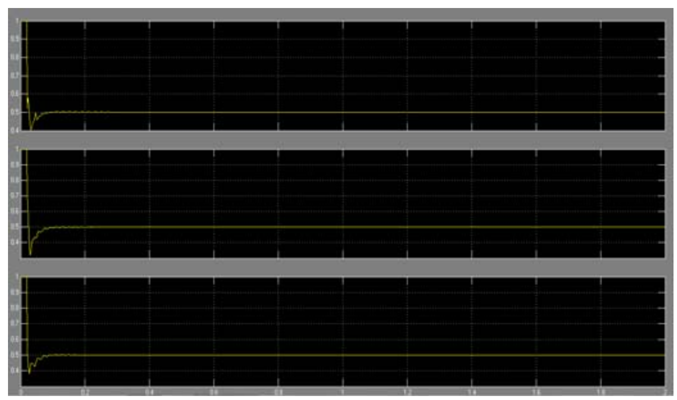

Fig. 12: Power factor without filter

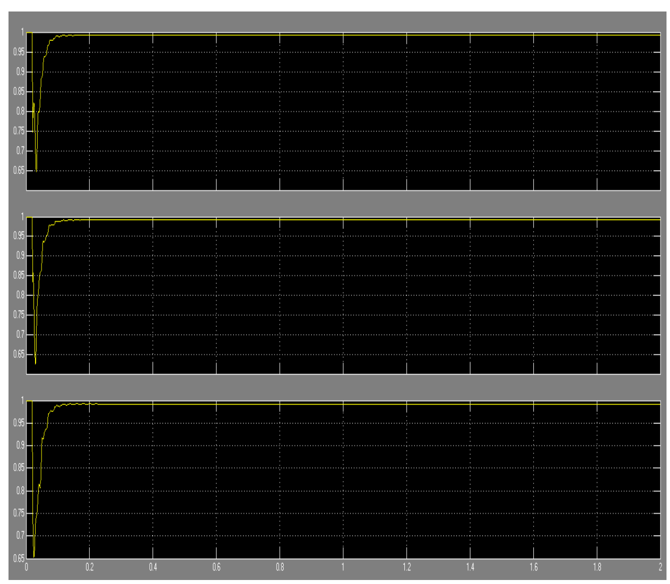

Fig. 13: Power factor with filter

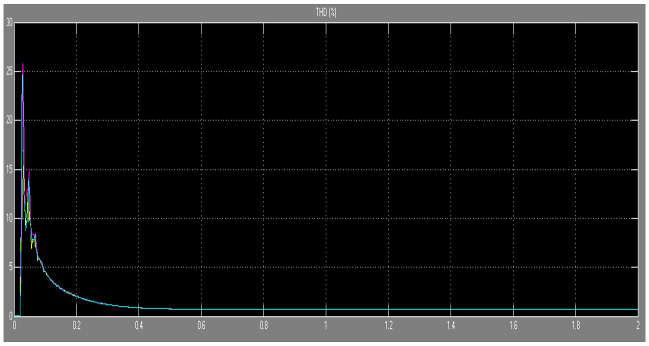

Fig. 14: THD without filter

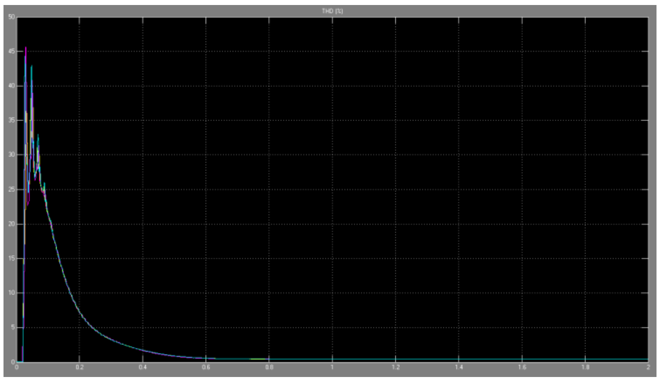

Fig. 15: THD with filter

5. PERFORMANCE TABLE

Sr. No	Method Adopted	P.F at no load	P.F at half load	P.F at full load	THD(%)
1.	Without improvement	0.50	0.51	0.52	0.70
2.	With Capacitor Bank	0.73	0.74	0.74	2.24
3.	With Power Filter	0.99	0.99	0.99	0.45

6. CONCLUSION

The paper presents low cost power factor improvement technique for voltage distribution system as well as domestic and commercial area. It is low cost voltage compensation device. It improve the power factor by using tri-loop controller. It reduces the THD and improves the low power factor. It also compensates the reactive power in the system. It increases the efficiency of the supply in any commercial, industrial and residential sector. As a result, efficiency of the overall system is increase and all energy utilized by the load. Power factor can be improved nearby unity.

REFERENCES

[1] A. M. Sharaf, Hassan A. Mahasneh and YevgenBiletskiy "A Novel Power Quality Enhancement Scheme in Low Voltage Distribution System Using Modulated Power Filter Compensator “, *IEEE Spectrum*, 2007, 1-4244-0632-3

[2] Rene Spee, Alan K. Wallace “Comparative Evaluation of Power-Factor Improvement Techniques For squirrel cage induction motors”, pp. CH 2935-5

[3] A.M. Shard, CaixiaGuo, Hong Huang "on Intelligent Control ", in Proceedings of the 12th IEEE International Symposium on Intelligent Control , Istanbul, Turkey, 16- 18 July 1997, pp. 7803-4116.

[4] BY Jerry C. Whitaker “AC Power Systems Handbook” Third Edition, Technical Press Morgan Hill, California.

[5] A.M. Sharaf, CaixiaGuo and Hong Huang “A Self Adjusting Power Filter For Industrial Nonlinear Loads” in Proceedings of the Conference on Communications, Power and Computing in 1997,ISBN 0-7803-4147-3.

[6] A.M. Sharaf - Pierre: Kreidi “Dynamic Compensation Using Swi'tched modulated Power Filters” in Proceedings of the 2002 IEEE Canadian Conference on Electrical & Computer Engineering,0-7803-7514-9/02.

[7] A.M. Sharaf,Weihua Wang “A Low-Cost Voltage Stabilization and Power Quality Enhancement Scheme for a Small Renewable Wind Energy Scheme” IEEE ISIE 2006, pp. 1949-1953.

[8] A.M. Sharaf, A. Aljankawey and I. H. Altas, “A Novel Voltage Stabilization Control Scheme for Stand-alone Wind Energy Conversion Systems” IEEE,1-4244-0632-3/07, pp. 514-519.

[9] Jain Sandesh, Thakur Shivendra Singh and Phulambrikar S.P., Improve Power Factor and Reduce the Harmonics Distortion of the System, R.J.E.S ‘ISSN 2278 – 9472 Vol. 1(5), 31-36’.

[10] A. Bhatia, “Power Factor in Electrical Energy Management”.