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Removal of Current and Voltage Harmonics in 3 Phase Four Wire System using Smart Filter

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Abstract: The new management topology for reduction of current harmonics in 3 part Four wire distribution system was given during this thesis .Starting with incandescent light-weight bulb each load these days creates harmonics. the difficulty of harmonics is of nice concern to engineers, building designers and additionally in industrial applications as a result of they are doing not just distort voltage waveforms, however they will conjointly overheat the building wiring, overheat transformer units, and cause end-user instrumentality failures. Thus, giving attention towards power quality has become necessary these days .The main objective of this project is to review and design good filter exploitation combination of fuzzy and PI controllers. In good filter only used single-phase inductances and capacitors, while not victimization any electrical device or special electromagnetic device. The simulation results supported MATLAB/ SIMULINK were performed to verify the effectiveness of good filter. This filter reduced current harmonics quite previous ways of reducing current harmonics.

Keywords: SIMLINK, Filter, smart Filter,

I. INTRODUCTION

Current harmonics in distribution grids mostly result from the widespread usage of nonlinear loads. Discharge lamps and power-electronics-based equipment's are two frequent examples of nonlinear loads in residential, commercial, and industrial facilities. Currents harmonics even have a sign cant effect on medium-voltage (MV) and 55 networks. Harmonics are number multiple of elementary frequency (i.e. 50 or 60 Hz) part which additional along resulted in distorted undulation. as an example second harmonic is two time of elementary (i.e. one hundred or one hundred twenty Hz), equally for third harmonic it' thrice of the elemental element (i.e. one hundred fifty or one hundred eighty Hz) then on. Thanks to extreme use of power converters and alternative non-linear loads in trade it's determined that it deteriorates the power systems voltage and current waveforms. Static power converters like single phase and three phase recti-fires, Thermistor converters and enormous variety of power electronic instrumentality are nonlinear loads that generate tidy disturbances within the ac mains. in the main voltage harmonics and power distribution issues arise thanks to current harmonics created by nonlinear loads. As nonlinear currents own through electrical system and therefore the distribution-transmission lines, extra voltage distortion turn out due to the electrical resistance related to the electrical network. The presence of harmonics in the power system cause larger power loss in distribution, interference drawback in communication system and, generally end in operation failure of electronic equipment's which square measure additional and additional sensitive as a result of it contains electronics controller systems, which work with terribly low energy levels.

It's noted that non-sinusoidal current results in several issues for the utility power offer company, like low power issue, low energy efficiency, magnetic attraction interference (EMI), distortion of line voltage etc. Passive filters are used as an answer to unravel harmonic current issues, however as a result of the many disadvantage of passive filter find it irresistible will mitigate solely few harmonics and gives rise to resonance drawback. in addition, passive filters have downside of bulk size. To deal with these benefits, recent efforts are focused within the development of active filters, that square measure able to compensate not solely harmonics however additionally uneven currents that is caused by nonlinear and unbalanced loads. owing to the exceptional progress within the last twenty years within the field of power physics devices with forced commutation ,active filters are extensively studied and an outsized variety of the works have been printed.

There are essentially two kinds of active filters: the shunt kind and series kind. The shunt-connected active power filter, with a self-controlled dc bus used for reactive power compensation in power transmission systems. Shunt active power filters compensate load current harmonics by injecting equal-but opposite harmonic compensating current. Series active power filters were introduced by the top of the Eighties and operate in the main as a voltage regulator and as a harmonic isolator between the nonlinear load and therefore the utility system. The series-connected filter protects the patron from Associate in nursing inadequate offer voltage quality. The series active filter injects a voltage element serial with the supply voltage and thus is considered a controlled voltage supply, compensating voltage sags and swells on the load aspect.

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Until currently several control methods have been developed however instant active and reactive current (id-iq) element technique and instant active and reactive power (p-q) methodology are additional common ways.

This project in the main concentrates on these two management methods (id-iq and p-q) with PI controller. Each ways square measure compared below distorted main voltage condition and it is found that id-iq control technique come through superior harmonic compensation performance.
The id-iq control is predicated on a synchronous rotating frame derived from the mains voltages while not the utilization of a phase-locked loop (PLL).By the id-iq management technique many synchronization issues square measure avoided and a really frequency-independent filter is achieved.

II. PROBLEM DEFINITION

From the previous literature review, it is observed that harmonic is an well known
problem of high complexity. To Solve this problem

- ❖ To provide compensation for harmonic load current components.
- ❖ To study the control strategy of the Smart Filter for the reduction of harmonic currents of the voltage source type of non-linear loads.
- ❖ To develop the non-linear model of three-phase SH-APF.
- ❖ To develop the non-linear model of three-phase Smart Filter.
- ❖ To check how this technique is better than others in terms of reliability and efficiency.

Actual working/ Problem Salving Approach:

1. Design FBS Power Filter
The pn-seq and also the z-seq voltage elements of the three-phase network that the filter is connected to also are described in Fig.5.1.

The FBS topology consists of three section branches with 3 identical single-phase impedances Zf and one neutral branch with a fourth single-phase ohmic resistance zn.

In Fig. the FBS power filter is connected to a generic three-phase network during which pn-seq voltage element u12 = [uao, ubo, uco] and z-seq voltage parts u0 are diagrammatic individually for the sake of informative the superposition analysis given within the following.

Once solely pn-seq parts are considered within the circuit of Fig.5.1, i.e., once it's assumed that u0 = zero, the middle nodes at the supply and filter sides (oo) square measure nearly connected, and hence, voo = 0.

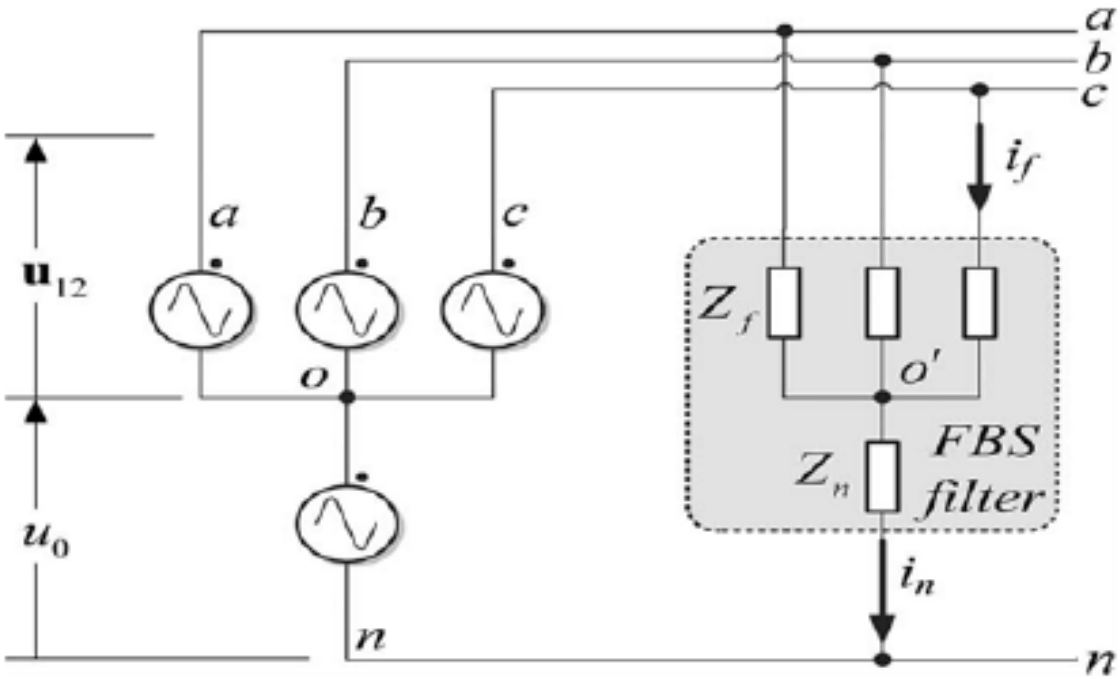

Figure: FBS power filter with generic branch impedances.

2. Variants of the FBS Passive Power Filter Implementation
Several filter variants will be derived from the generic FBS filter structure of Fig. Some of these explicit structures of the FBS power filters and conferred within the following.

In these power filters, the quantity of freedom degrees for setting the resonance frequencies and quality factors is reduced within the pursuit of achieving an easier and additional economical implementation whereas at an equivalent time keeping a satisfactory harmonic cancellation characteristic.

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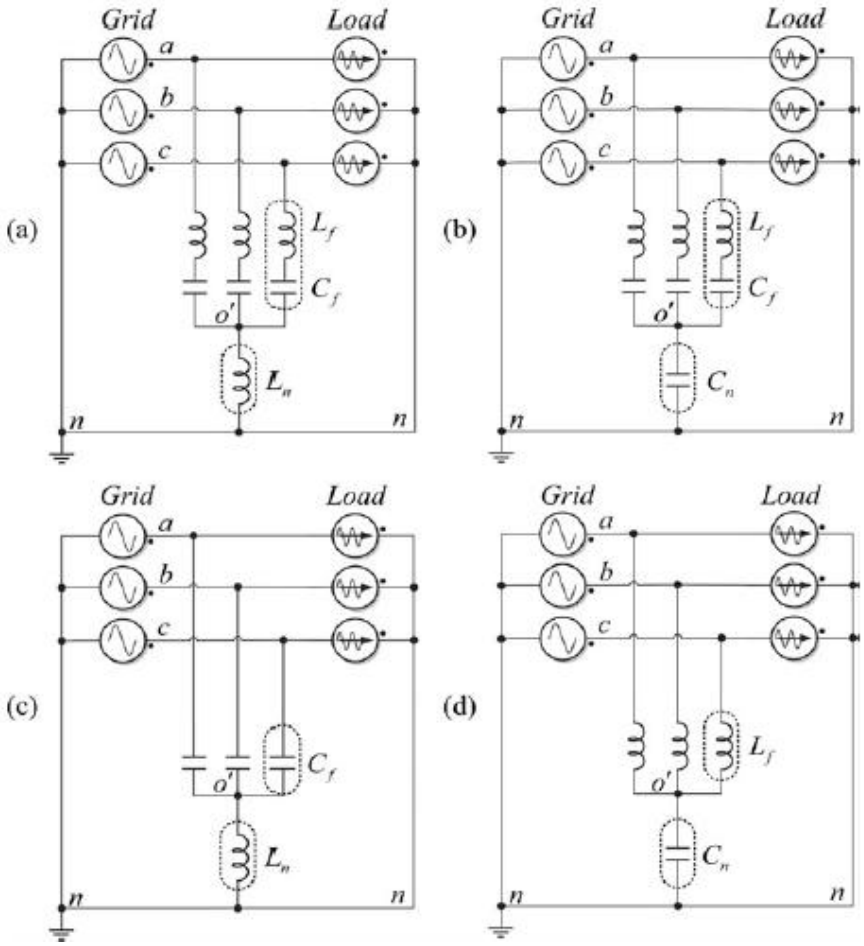

Figure: Variants of the FBS Passive Power Filter Implementation

III. RESULTS

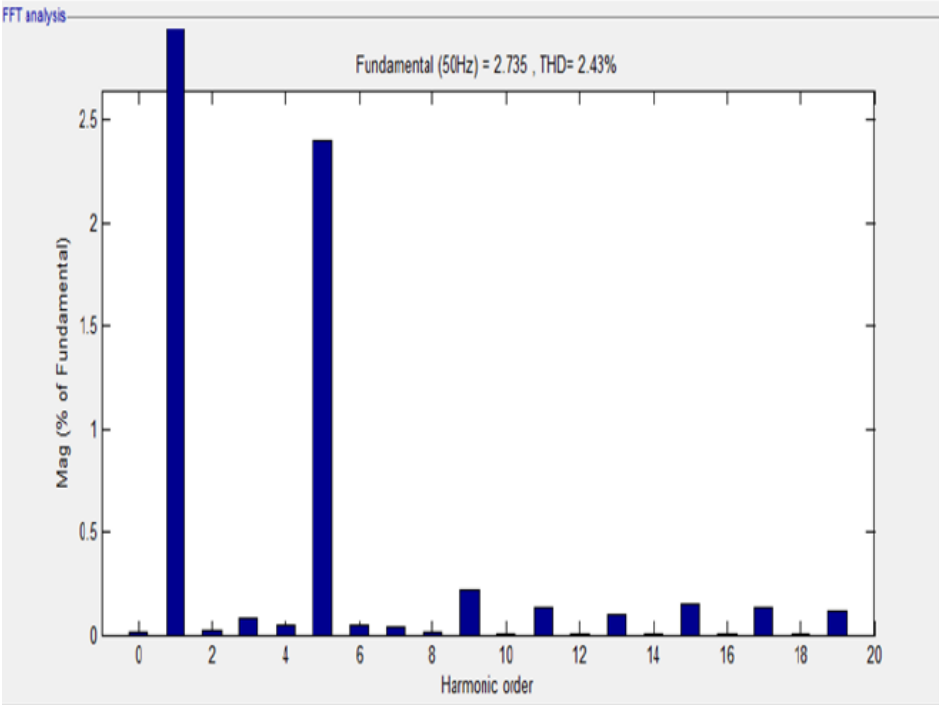

Figure: FFT analysis for source current.

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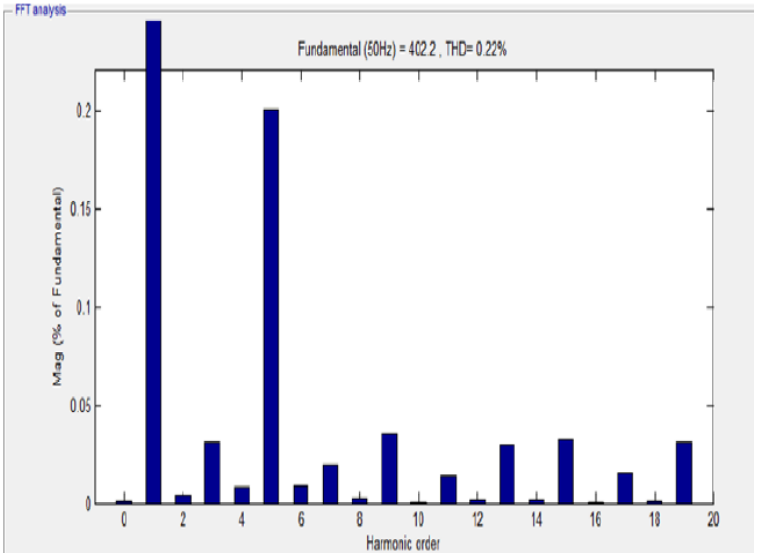

Figure: FFT analysis for load current.

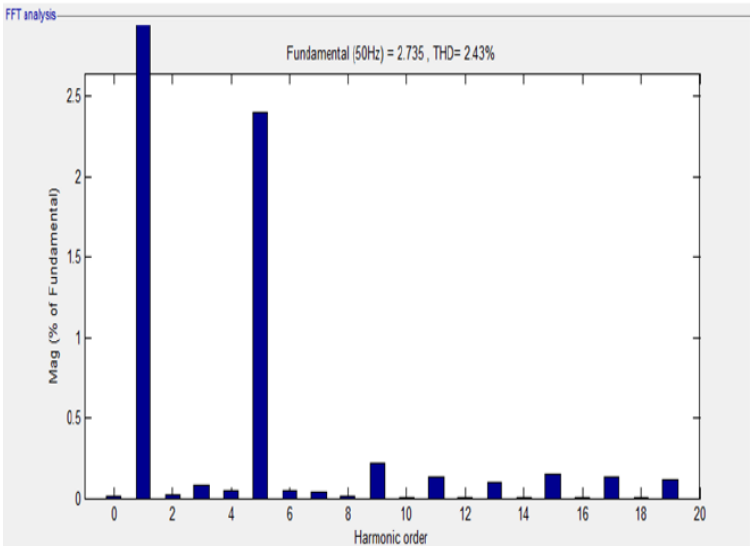

Figure: FFT analysis for source-Load current.

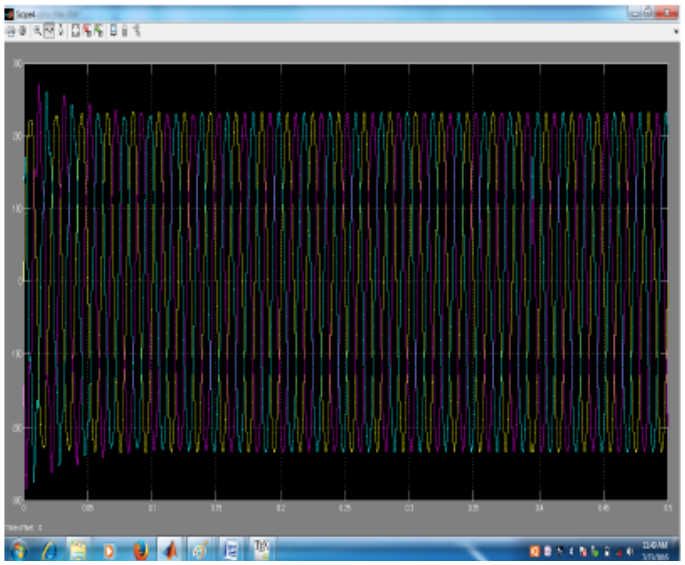

Figure: Simulation Result of Source voltage.

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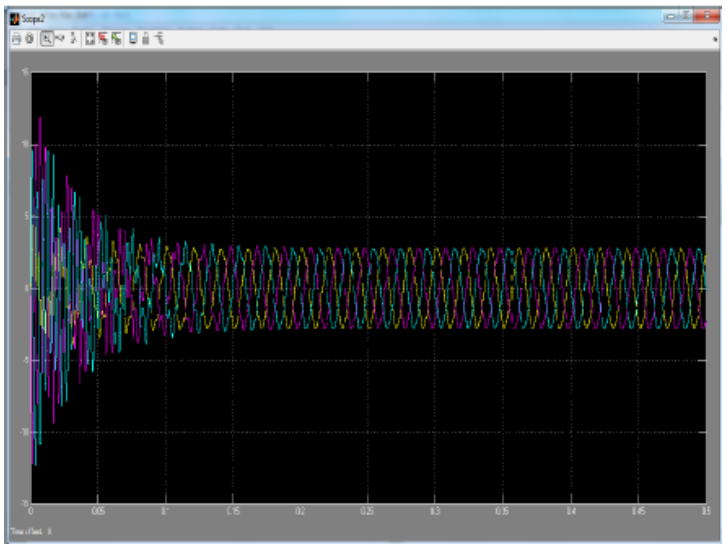

Figure: Simulation Result of Source Current.

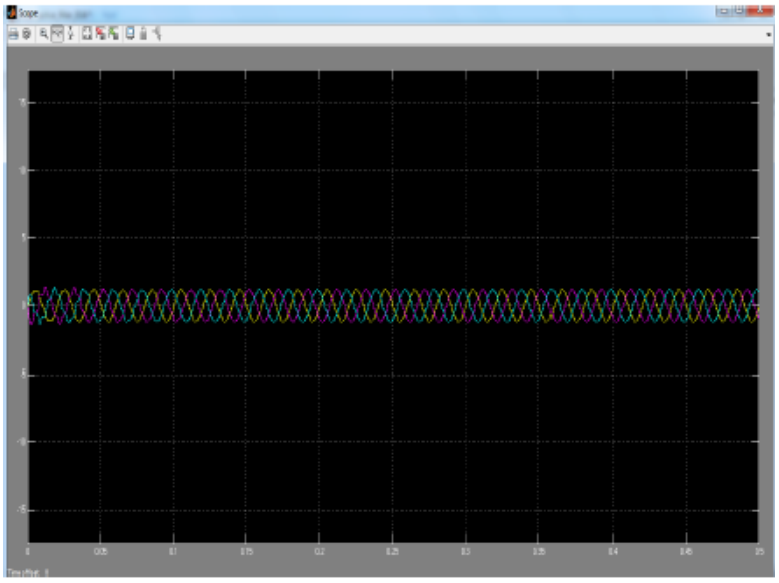

Figure: Simulation Result of load current.

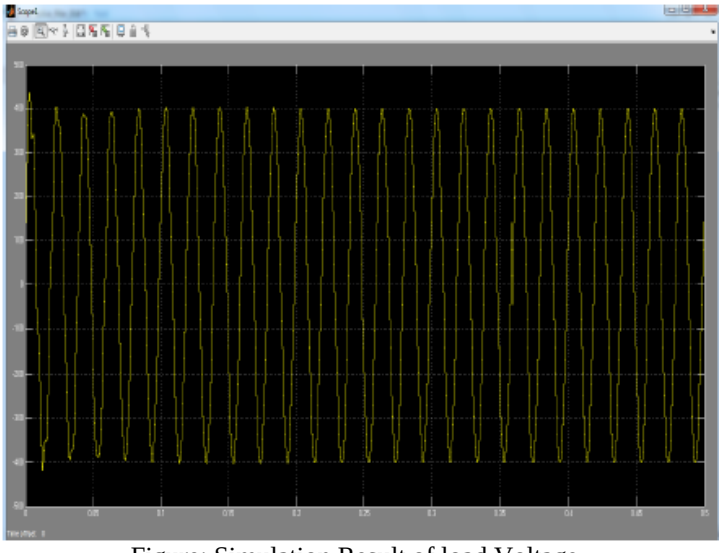

Figure: Simulation Result of load Voltage.

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IV. CONCLUSION

In this thesis two controllers are developed and verified with three parts four wire system. Even if each controllers area unit capable to compensate the current and voltages harmonics in the three part 4-wire system, it's determined that the fuzzy controller shows a lot of dynamic performance over typical PI controller. Source voltage and current This is satisfactory reduced by exploitation good lter that are check by Simulink / Matlab software system.

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