

Intelligent Power Control on Distribution System Using Hybrid Active Power Filters with Fuzzy Logic Controller

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Abstract- Power quality is one of the major problem in the electrical distribution network, out of various power quality problems; harmonics problem is major in distribution network. Various types of power controllers are used controlling the power however there may contains some harmonics in system so the system is proposed for mitigation of power quality problem in the distribution network for harmonic compensation so the Hybrid Active power filter is proposed for power quality improvement the use of Fuzzy logic Controller with Hybrid Active power filters is required This work proposes a Fuzzy Logic Controlled based Active power filters with Hysteresis controller along with RES integration In the proposed system the HAPF will perform the function of harmonic elimination, and the power quality is simulated using MATLAB/SIMULINK.

Index Terms- Fuzzy Logic Controller, Hybrid Active power filters, Hysteresis current controller.

I. INTRODUCTION

The power is generated by the power stations and distributed to the consumers at the distribution the power must reliable and must be very efficient in the consumers end .However harmonics are generated on the AC system may cause the unstable on the electrical power .So to improve the power on the electrical network by not only compensating the Real and Reactive power and also Harmonics in the system the usage of Active power filters and it is controlled by an Fuzzy Logic controller can be used to enhance the power

II HAPF & FLC POWER CONTROL

Active power filters are usually employed to solve the power quality problems. In this paper, a PV generating system is connected to grid and the PQ is maintained without using HAPF (Active Power filter)

[7] .There are different ways by which PQ can be maintained. Here, we have Conventionally, PI, PD and PID controller are most popular controllers and widely used in most power electronic appliances however recently there are many researchers reported successfully adopted Fuzzy Logic Controller (FLC) to become one of intelligent controllers to their appliances. Two independent fuzzy controllers have been designed for DG interface and that controllers will perform the function of active power filtering (eliminating harmonics), thereby increasing efficiency, reliability and quality.

III. HYBRID ACTIVE FILTERS

Technical limitations of conventional APFs can be overcome with hybrid APF configurations. They are typically the combination of basic APFs and passive filters. Hybrid APFs, inheriting the advantages of both passive filters and APFs provide improved performance and cost-effective solutions. .

The idea of hybrid APF has been proposed by several researchers. In this scheme, a low cost passive high-pass filter (HPF) is used in addition to the conventional APF. The harmonics filtering task is divided between the two filters. The APF cancels the lower order harmonics, while the HPF filters the higher order harmonics. The main objective of hybrid APF, therefore is to improve the filtering performance of high-order harmonics while providing a cost-effective low order harmonics mitigation.

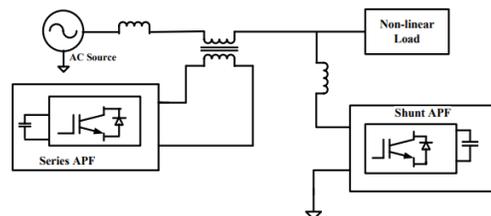


Fig 1 Hybrid Active power Filter

And the types of the Hybrid active power filters are given as follows

1. Shunt Filter and Series Filter
2. Shunt APF and series PF
3. APF and Shunt PF
4. APF in series with shunt PF

IV-HYSTRESIS CURRENT CONTROLLER

Hysteresis current control is one of the simplest techniques used to control the magnitude and phase angle of motor current for motor drives systems. However, this technique presents several disadvantages such as operation at variable switching frequency which can reveal problems of filtering, interference between the phases in the case of the three-phase systems with insulated neutral connection or delta connection, and irregularity of the modulation pulses which especially causes an acoustic noise on the level of the machine for the high power drive. In this paper, a new technique is proposed for a variable-hysteresis-band controller based on dead beat control applied to three phase voltage source PWM inverters feeding the electrical network. Its main aim is firstly ensure a Constant switching frequency and secondly the Synchronization of modulation pulses using the phase-locked-loop with loop gain compensation in order to ensure a better stability.

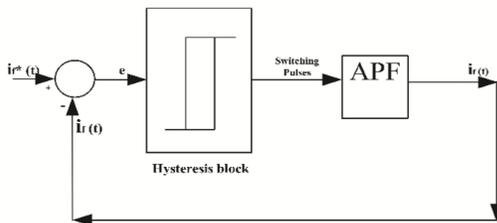


Fig 2 .Hysteresis current controller

V. CONTROL PROCESS

The Hybrid active power filters are used to filter out higher as well as lower order harmonics in the power system. The report deals with the basic working and classifications of hybrid active power filters, its reference signal generation techniques and some of the controlling schemes of HAPF. One of the key points for a proper implementation of an active filter

is to use a good method for current/voltage reference generation.

There exist many implementations supported by different theories proposing ever better solutions with commonly used theories. Also for efficient working of active power filter better controlling techniques have to be implemented. The paper presents a brief study of active power filter (HAPF) with hysteresis current controller control strategies put forward recently. It is aimed at providing a broad perspective on the status of HAPF control methods for better operation of the system the types of the active power configuration is based on the arrangement on the filters with respective to their arrangement with respective to the non-linear load with the three phase supply so that it is used to control the power on the utility grids.

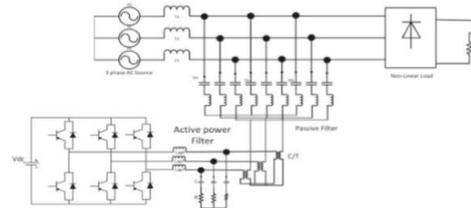


Fig 3: HAPF Connected to a Network

A fuzzy control system is a control system based on fuzzy logic a mathematical system that analyzes analog input values in terms of logical variables that take on continuous values between 0 and 1, in contrast to classical or digital logic, which operates on discrete values of either 1 or 0 true or false.

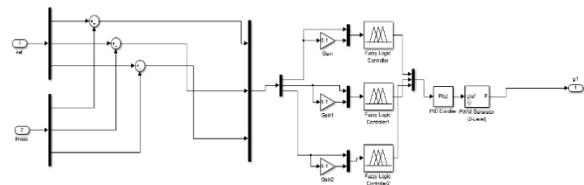


Fig 4 .Fuzzy logic control

The above configuration represents a fuzzy logic controller connected to an active power filters which the power from the active power filters is now controlled by reducing harmonics by obtaining the control over the current and voltage. Active power filter generates compensating currents and induces these generated compensated currents in to the system thus mitigating harmonics in the system.

Unwanted neutral currents might flow caused due to non-linear loads with uncompensated and unbalanced systems. In this case, a three phase APF can deliver.

VI SIMULATION RESULTS

The system for the Hybrid active power filters connected to the non –linear load to the system is controlled by the hysteresis current controller and the it is further controlled by the fuzzy logic controller produces a simulation results with controlled in th harmonics compared to the previous system bases with FACTS/PI controller .

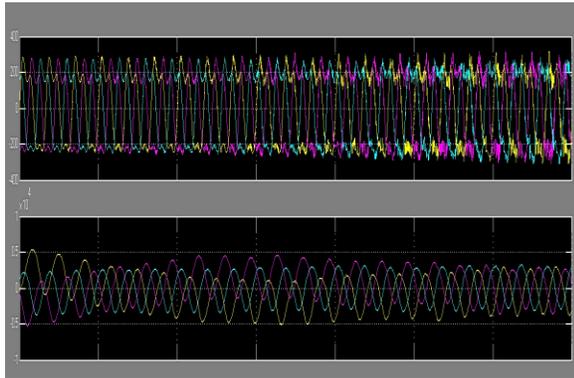


Fig 5 Output side without FLC &HAPF

The above figure shows the simulation results of Hybrid Active Power Filter without compensation of APF &FLC (i.e., before injecting into APF) , the voltage has have harmonics and its amplitude is in the range of 500-1000v and its current is in range of $(0.5-1)*10^4$ A.

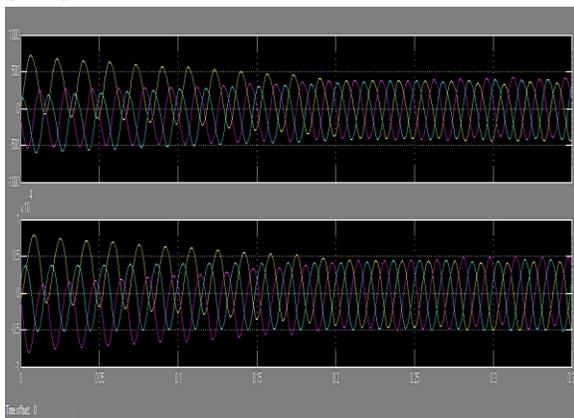


Fig 6. Output side with FLC &HAPF

The above figure shows the simulation results of Hybrid Active Power Filter with compensation. With compensation of APF &FLC, the voltage has less harmonics and its amplitude is in the range of 200-400v and current is in range of 0.5A.

S.N O.	PARAMETERS	EXISTING	PROPOSED
1.	Harmonic order: 1 st 3 rd 5 th	36.50 7.448 4.457	36.12 0.4667 0.1683
2.	% of source current THD	3.35	2.159
3.	% of load current THD	40.34	32.58
4.	POWER FACTOR	0.8389	0.9192
5	RMS CURRENT	7.665	6.300

Fig 7 Comparison table

VII. CONCLUSION

So when a system connected with a non-linear load connected to a power system it can effectively produce the harmonics in the sytem which may cause the system to losse its stability so inoder to improve quality of power at the consumer end and to meet the day to day load Instead of using separate converter for Distribution side separate converter for power quality improvement, here we are integrating FLC with HAPF. The HAPF is controlled by both Hysteresis controller and Fuzzy Logic Controller. Here simulation results are presented for without HAPF&FLC integration, with DG and PI controller and With APF and fuzzy controller. The THD s at PI and fuzzy controller is presented compared to PI, fuzzy have less THD

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