

An Hybrid PI-Fuzzy Controlled Strategy Based Active Power Filter for Renewable PGS

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Abstract

Implementation of intelligence controller by using voltage as feedback for significantly improving the dynamic performance of advanced compensator analysis of several control strategies fed APF for power quality improvement features is presented. Fuzzy control has emerged as one of the most active and fruitful areas for research in the applications of fuzzy set theory, especially in the realm of industrial process, which do not lend of quantities data regarding the input output relations. Utility distribution network, sensitive industrial loads and critical commercial operations suffer from various types of outages and services interruptions which can most significant financial losses. An active power filter implemented with a four-leg voltage source inverter using a predictive control scheme is presented. The use of four leg voltage source inverters allows the compensation of current harmonic as well as unbalanced current generated by single phase nonlinear loads. A detailed yet sim-

ple mathematical model of the active power filter, including the effect of the equivalent power system impedance, is derived and used to design the predictive control algorithm. In this Work Hybrid Fuzzy with PI controller was presented. The compensation performance of the proposed active power filter and the associated intelligence control scheme under steady state and transient operating conditions is demonstrated to improve the power quality is simulated using MATLAB/SIMULINK.

Key Words: Active power filter, current control, four-leg converters, predictive control, PI, FUZZY, HPF
JEL Classification: C 000.

1 INTRODUCTION

Sustainable age influences control quality because of its nonlinearity, since sun based age plants and wind control generators must be associated with the network through high-control static PWM converters [1]. The nonuniform idea of energy age straightforwardly influences voltage control and makes volt-age twisting in control frameworks. This new situation in control dissemination frameworks will require more refined remuneration procedures.

Albeit dynamic power channels executed with three-stage four-leg voltage-source inverters (4L-VSI) have just been displayed in the specialized writing [2] [6], the essential commitment of this paper is a prescient control calculation composed and actualized particularly for this application. Generally, dynamic power channels have been controlled utilizing pretuned controllers, for example, PI-type or versatile, for the present and also for the dc-voltage circles [7], [8]. PI controllers must be de-marked in light of the proportionate straight model, while prescient controllers utilize the nonlinear model, which is nearer to genuine working conditions. An exact model acquired utilizing prescient controllers enhances the execution of the dynamic power channel, particularly amid transient working conditions, since it can rapidly take after the present reference flag while keeping up a consistent dc-voltage.

Up until this point, executions of prescient control in control converters have been utilized basically in acceptance engine drives [9] [16]. On account of engine drive applications, prescient, multi-

variable attributes, disentangles the treatment of dead-time remunerations, and grants beat width modulator substitution. Be that as it may, these sorts of utilizations display dis-favorable circumstances identified with motions and insecurity made from obscure load parameters [15]. One preferred standpoint of the proposed calculation is that it fits well in dynamic power channel applications, since the power converter yield parameters are outstanding [17]. These yield parameters are gotten from the converter yield swell channel and the power framework comparable impedance. The converter yield swell channel is a piece of the dynamic power channel plan and the power framework impedance is gotten from surely understood standard methods [18], [19]. On account of obscure framework impedance parameters, an estimation strategy can be utilized to infer an exact R L equal impedance model of the framework [20].

This paper displays the numerical model of the 4L-VSI and the standards of activity of the proposed prescient control plot, including the outline strategy. The total description of the chose current reference generator actualized in the dynamic power channel is additionally displayed. At long last, the genius postured dynamic power channel and the viability of the related control conspire remuneration are exhibited through reenactment and approved with test comes about got in a 2 kVA research center model

2 INVERTER FOUR LEG MODELING

Fig. 1 demonstrates the design of an ordinary power conveyance framework with sustainable power age. It comprises of different sorts of energy age units and diverse kinds of burdens. Sustainable sources, for example, wind and daylight, are normally used to create power for private clients and little ventures. The two kinds of energy age utilize air conditioning/air conditioning and dc/air conditioning static PWM converters for voltage change and battery banks for longterm vitality stockpiling. These converters perform most extreme power guide following toward separate the greatest vitality conceivable from wind and sun. The electrical vitality utilization conduct is irregular and eccentric, and accordingly, it might

be single-or three-stage, adjusted or unequal, and direct or nonlinear.

A dynamic power channel is associated in parallel at the purpose of basic coupling to repay current music, current unbalance, and receptive power. It is formed by an electrolytic capacitor, a four-leg PWM converter, and a first-arrange yield swell channel, as appeared in Fig. 2. This circuit considers the power framework equal impedance Z_s , the converter yield swell channel impedance Z_f , and the heap impedance Z_L .

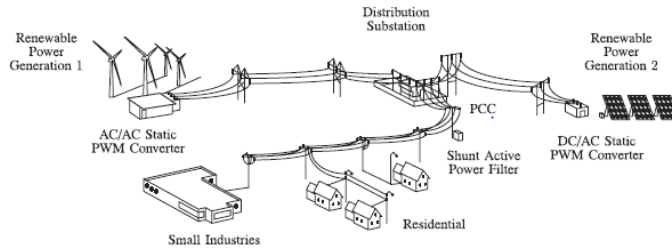


Fig. 1. Stand-alone hybrid power generation system with a shunt active power filter

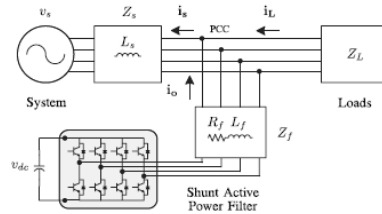


Fig. 2. Three-phase equivalent circuit of the proposed shunt active power filter.

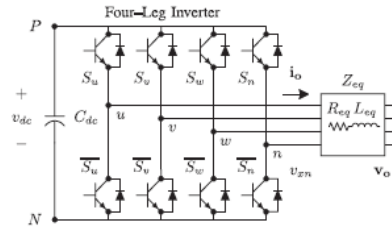


Fig. 3. Two-level four-leg PWM-VSI topology

3 PREDICTIVE CURRENT CONTROL

The square graph of the proposed advanced prescient current control conspire is appeared in Fig. 4. This control plot is basically an advancement calculation and, along these lines, it must be implemented in a chip. Thusly, the examination must be created utilizing discrete arithmetic so as to consider extra limitations, for example, time deferrals and approximations.

The primary normal for prescient control is the utilization of the framework model to foresee the future conduct of the factors to be controlled. The controller utilizes this data to choose the ideal exchanging state that will be connected to the power converter, as per predefined enhancement criteria. The prescient control calculation is anything but difficult to execute and to comprehend, and it can be actualized with three fundamental squares, as appeared in Fig. 4

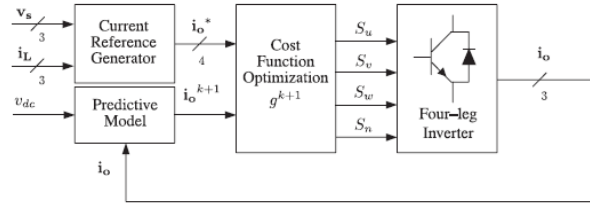


Fig. 4. Proposed predictive digital current control block diagram.

4 CURRENT REFERENCE GENERATION

A dq-based current reference generator conspire is utilized to obtain the dynamic power channel current reference signals. This plan displays a quick and exact flag following capacity. This characteristic maintains a strategic distance from voltage changes that break down the present reference flag influencing remuneration execution [28]. The present reference signals are gotten from the comparing load streams as appeared in Fig. 5. This module computes the reference flag streams required by the converter to repay receptive power, current symphonious, and current unevenness. The reloca-

tion control factor ($\sin \Phi(L)$) and the most extreme aggregate symphonious mutilation of the Load THD.

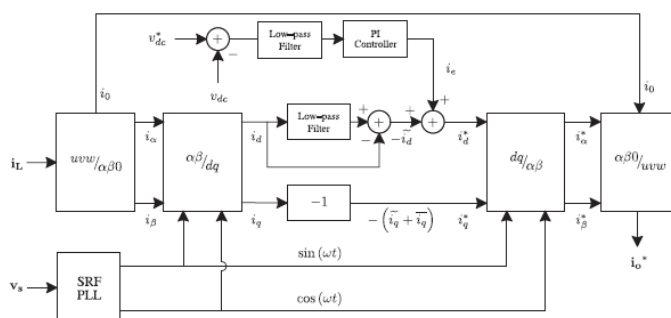


Fig. 5. d_q -based current reference generator block diagram

5 SIMULATION RESULTS

Case 1: Proposed RES Fed APF with Conventional Fuzzy Controller

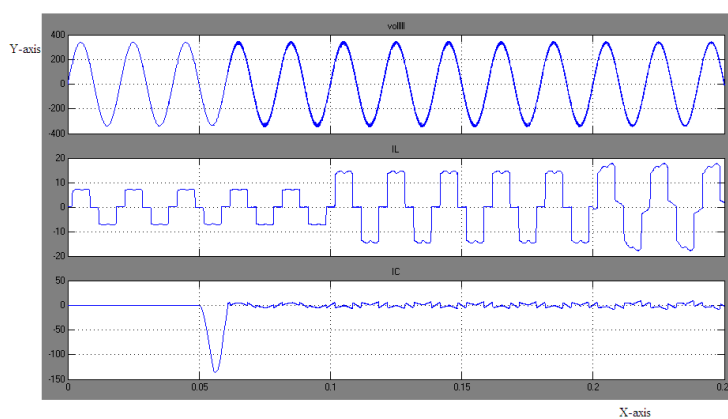


Fig: 6 Simulation results for APF with Formal Fuzzy Controller

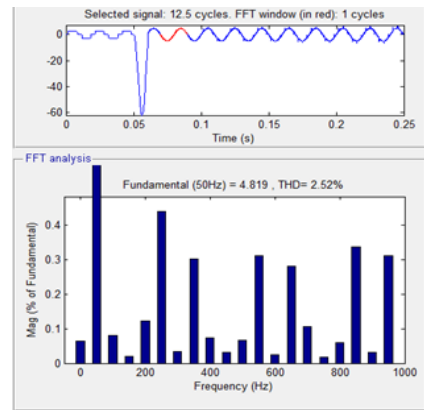


Fig: 7 THD Analysis for APF with Formal Fuzzy Controller

Case 2: Proposed RES Fed APF with Conventional HPF Controller.

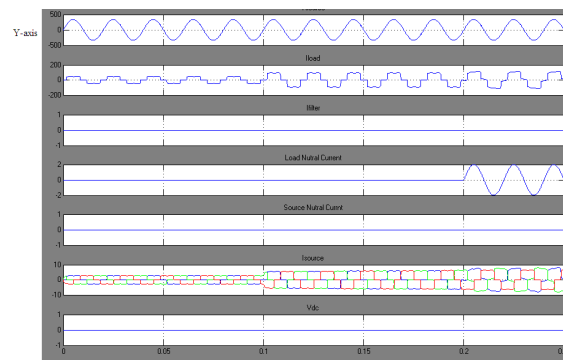


Fig: 8 Simulation results for APF with Formal HPF Controller

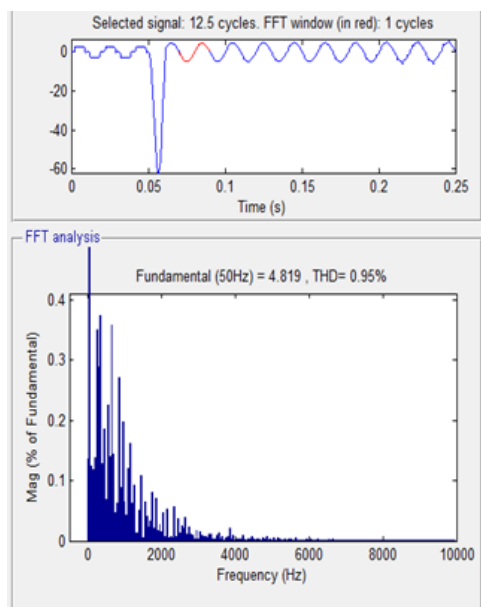


Fig: 9 THD Analysis for APF with Formal HPF Controller

6 CONCLUSION

Enhanced dynamic current music and a responsive power remuneration conspire for control conveyance frameworks with age from inexhaustible sources has been proposed to enhance the present nature of the dispersion framework. Favorable circumstances of the proposed conspire are identified with its effortlessness, demonstrating, and execution. The utilization of a prescient control calculation for the converter current circle ended up being a successful answer for dynamic power channel applications, enhancing current following ability, and transient reaction. Recreated and exploratory outcomes have demonstrated that the proposed prescient control calculation is a decent contrasting option to traditional straight control strategies. The prescient current control calculation is a steady and hearty arrangement. Reenacted and trial comes about have demonstrated the pay viability of the proposed dynamic power channel.

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