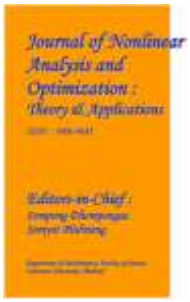
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 13, No. 1, (2022),
ISSN : **1906-9685**



BUILD THE DESIRED COMPENSATION ACTIVE POWER FILTER-BASED CURRENT USING OFFSET COMMAND INSTANTANEOUS CURRENT DISTORTION

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ABSTRACT
Because the load in distribution systems fluctuates suddenly and is nonlinear, it pulls non-sinusoidal currents from the AC mains, which results in load harmonics, reactive power, and excessive neutral currents that pollute power systems. The nonlinear properties and quick switching of power electronic equipment are to blame for the majority of pollution issues that arise in power systems. The most practical option is thought to be a shunt active filter based on current driven PWM converters. In this study, we describe the IP controlled shunt active harmonics and reactive power correction from 3P4W micro-grid distribution system. The method that produces required compensation current extraction based on offset command instantaneous currents that are distorted or voltage signals in the time domain because compensation time domain response is quick, easy implementation and lower computational load compared to the frequency domain.
Keywords: BESS, Circuit breaker, switch off time period, ESS.

INTRODUCTION

Since high-power static PWM converters are required to link solar power plants and wind turbine generators to the grid, renewable generating has a nonlinear impact on power quality [1]. Voltage control is directly impacted by the unevenness of power generation, which also leads to voltage distortion in power systems. More advanced compensating mechanisms will be needed to address this new scenario in power distribution networks. The main contribution of this study is a predictive control algorithm created and developed particularly for this application, even though active power filters implemented with three-phase four-leg voltage-source inverters (4L-VSI) have already been reported in the technical literature [2]-[6]. Active power filters have historically been managed using pretended controllers for both the current and dc-voltage loops, such as PI-type or adaptive controllers. [7], [8]. PI controllers must be designed based on the equivalent linear model, while predictive controllers use the nonlinear model, which is closer to real operating conditions. An accurate model obtained using predictive controllers improves the performance of the active power filter, especially during transient operating conditions, because it can quickly follow the current-reference signal while maintaining a constant dc-voltage. So far, implementations of predictive control in power converters have been used mainly in induction motor drives[9]–[16].

In the case of motor drive applications, predictive control represents a very intuitive control scheme that handles multivariable characteristics, simplifies the treatment of dead-time compensations, and permits pulse- width modulator replacement. However, these kinds of applications present disadvantages related to oscillations and instability created from unknown load parameters [15]. One advantage of the proposed

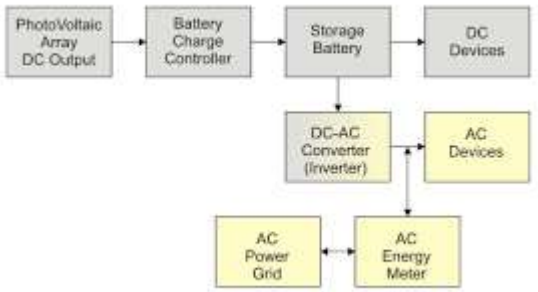
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algorithm is that it fits well in active power filter applications, since the power converter output parameters are well known [17]. These output parameters are obtained from the converter output ripple filter and the power system equivalent impedance. The converter output ripple filter is part of the active power filter design and the power system impedance is obtained from well-known standard procedures [18], [19]. In the case of unknown system impedance parameters, an estimation method can be used to derive an accurate *R–L* equivalent impedance model of the system [20]. This paper presents the mathematical model of the 4L-VSI and the principles of operation of the proposed predictive control scheme, including the design procedure. The complete description of the selected current reference generator implemented in the active power filter is also presented. Finally, the proposed active power filter and the effectiveness of the associated control scheme compensation are demonstrated through simulation and validated with experimental results obtained in a 2 kVA laboratory prototype.

OVER VIEW

Photovoltaic systems are composed of interconnected components designed to accomplish specific goals ranging from powering a small device to feeding electricity into the main distribution grid. Photovoltaic systems are classified according to the diagram in Figure. The two main general classifications as depicted in the figure are the stand-alone and the grid-connected systems [9]. The main distinguishing fact tor between these two systems is that in stand-alone systems the solar energy output is matched with the load demand. To cater for different load patterns, storage elements are generally used and most systems currently use batteries for storage. If the PV system is used in conjunction with another power source like a wind or diesel generator then it falls under the class of hybrid systems. The balances of system (BOS) components are a major contribution to the life cycle costs of a photovoltaic system. They include all the power conditioning units, storage elements and mechanical structures that are needed. They especially have a huge impact on the operating costs of the PV system.

Fig.1. Model of power generation.



RELATED STUDY

In a modern power system, increasing of loads and nonlinear equipment's have been demanding the compensation of the disturbances caused for them. These non-linear loads may cause poor power factor and high degree of harmonics. Active power filter (APF) can solve problems of harmonic and reactive power simultaneously. APF's consisting of voltage source inverters and a dc capacitor have been researched and developed for improving the power factor and stability of transmission systems. APF have the ability to adjust the amplitude of the synthesized ac voltage of the inverters by means of pulse width modulation or by control of the dc-link voltage, thus drawing either leading or lagging reactive power from the supply. APF's are an up-to-date solution to power quality problems. Shunt APF's allows the compensation of current harmonics and unbalance, together with power factor correction, and can be a much better solution than conventional approach (capacitors and passive filters). The simplest method of eliminating line current harmonics and improving the system power factor is to use passive LC filters. However, bulk passive components, series and parallel

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resonance and a fixed compensation characteristic are the main drawbacks of passive LC filters. Harmonic compensations havebecome increasingly important inpower systems due to the widespreaduse of adjustable-speed drives, arcfurnace, switched-mode powerSupply, uninterruptible power supply,etc. Harmonics not only Increase thelosses but also produce unwanteddisturbance to the communication network, more voltage and/or currentStress, etc. Different mitigationsolutions, e.g., passive filter, Activepower line conditioner, and also hybrid filter, have been Proposed and used. Recent technological advancement of switching devices and availability of cheaper controllingdevices, E.g., DSP-/field-programmable-gate-array-based system, Make active power line conditioner a natural choice tocompensate for harmonics. Shunt-typeactive power filter (APF) is used to eliminate the current harmonics. The dynamic performance of an APF is mainly dependent on how quickly and how accurately the harmonic components are extracted from the load current. Many harmonic extraction Techniques are available, and their responses have been explored. In this project a new concept is proposed that is FBDalgorithm in three-phase four-wireshunt active power filter to compensate the harmonics. In APF design and control, instantaneous reactive power theory was often served as the basis for the calculation of compensation current. In this theory, the mains voltage was assumed to be an ideal source in the calculation process. However, in most of time and most of industry power systems, mains voltage may be unbalanced and/or distorted. Under such scenarios, this theory may not bevalid for application.

The *p–q* theory, since itsproposal, has been applied in the control of three-phase active power filters. However, power system voltages being often non-ideal, in distorted voltage systems the control using the *p–q* theory does not provide good performance. For improving APF performance under non-ideal mains voltages, new control methods are proposed by Komatsu and Kawabata and Huang and Chen and Hsu. In this paper, the proposedcontrol algorithm.

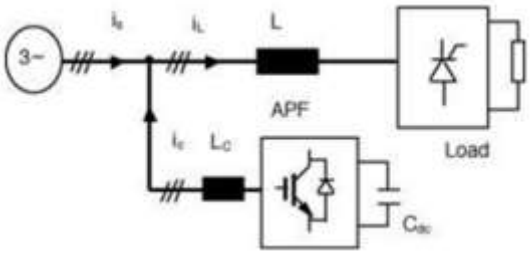


Fig.3.1. Proposed model.

PROPOSED SYSTEM

Renewable generation affects powerquality due to its nonlinearity, since solar generation plants and wind power generators must be connected to the grid through high-power static PWM converters. The non uniform nature of power generation directly affects voltage regulation and creates voltage distortion in power systems. This new scenario in power distribution systems will require more sophisticated compensation techniques. Although active power filters implemented with three-phase four-leg voltage-source inverters (4L- VSI) have already been presented in the technical literature, the primary contribution of this project is a predictive control algorithm designed and implemented specifically for this application. Traditionally, active power filters have been controlled using pre tuned controllers, such as PI-type or adaptive, for the current as well as for the dc-voltage loops. PI controllers must be designed based onthe equivalent linear model, while predictive controllers use the nonlinear model, which is closer to real operating conditions. An accurate model obtained using predictive controllers improves the performance of the active power filter, especially during transient operating conditions, because it can quickly follow the current-reference signal while maintaining a constant dc-voltage. So far, implementations of predictive control in power converters have been used mainly in induction motor drives. In the case of motor drive applications, predictive controlrepresents a very intuitive control scheme that handles multivariable characteristics, simplifies the treatment of dead-time compensations, and permits pulse- width modulator replacement. However, these kinds of applications present disadvantages related to oscillations and instability created from unknown load parameters.

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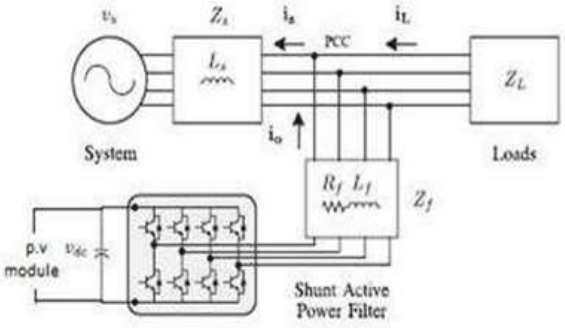


Fig.4.1 Model

SIMULATION RESULTS

In Circuit diagram main three phase voltage will be applied input side and output side three phase converters using to convert three phase to DCvoltage and here we are using DC to three phase inverter with high accuracy. The compensationeffectiveness of the active power filteris corroborated in a 2 kVA experimental setup. A six-pulse rectifier was selected as a nonlinear load in order to verify the effectiveness of the current harmonic compensation. A step load change was applied to evaluate the transient response of the dc voltage loop. Finally, an unbalanced load was used to validate the performance of the neutral current compensation.

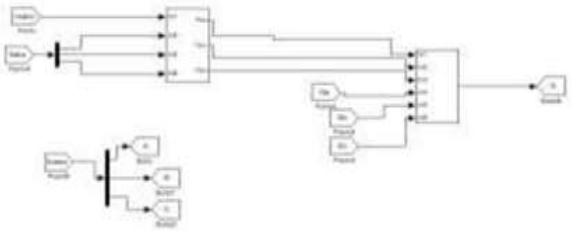


Fig.4.1. controller circuit.

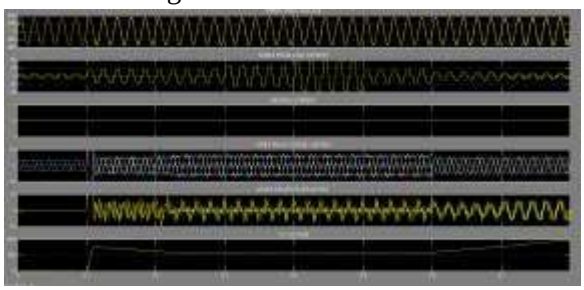
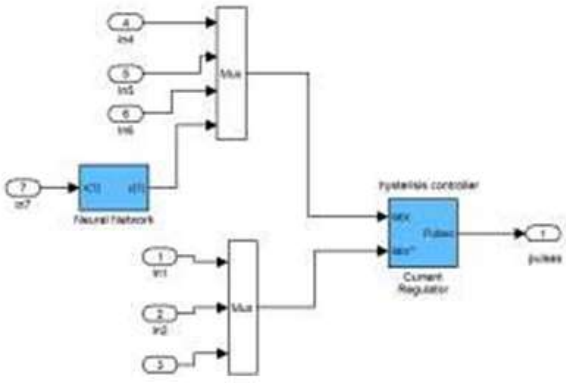


Fig.4.2. Simulation Results.

Extension circuit with ANN controller:



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Fig.5.3 ANN controller.

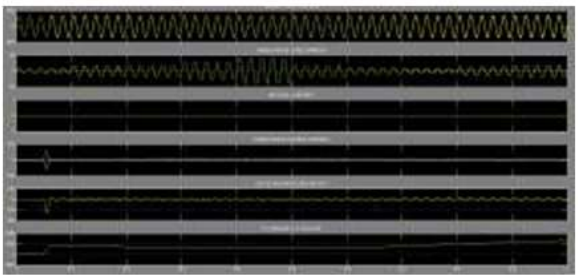


Fig.5.4. Output results with ANNcontroller.

CONCLUSION

After adding a PV module as an input to an active power filter, which involves compensating for reactive power and current harmonics by quantitatively lowering the source current's total harmonic distortion from 30% to 6% on average, the performance of the system has improved. Causing a significant increase in the distribution system's quality of power because of its simplicity, the predictive algorithm has been shown to be a superior alternative to traditional converters for managing non-linear and unbalanced loads. When utilizing active filters, where the maximum THD value is 5%, 95% accuracy or efficiency is obtained.

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