



International Journal for Innovative Engineering and Management Research

A Peer Reviewed Open Access International Journal

www.ijiemr.org

COPY RIGHT

2019IJIEMR. Personal use of this material is permitted. Permission from IJIEMR must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating new collective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works. No Reprint should be done to this paper, all copy right is authenticated to Paper Authors

IJIEMR Transactions, online available on 29TH Apr 2019. Link

[:http://www.ijiemr.org/downloads.php?vol=Volume-08&issue=ISSUE-04](http://www.ijiemr.org/downloads.php?vol=Volume-08&issue=ISSUE-04)

Title: **DESIGN AND PERFORMANCE OF COMPENSATOR FOR INCREASE THE POWER QUALITY BY USING FUZZY CONTROLLER**

Volume 08, Issue 04, Pages: 351–358.

Paper Authors

P HARIKA

ANURAG COLLEGE OF ENGINEERING, Ghatkesar, T.S, India.



USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per **UGC Guidelines** We Are Providing A Electronic Bar Code

DESIGN AND PERFORMANCE OF COMPENSATOR FOR INCREASE THE POWER QUALITY BY USING FUZZY CONTROLLER

P HARIKA

Research scholar, Dept of EEE, ANURAG COLLEGE OF ENGINEERING, Ghatkesar, T.S, India.

ABSTRACT:

Harmonic air pollution of the energy deliver procedure has risen tremendously in latest years due exceptionally to an increase of non-linear masses linked to the utility by way of residential, industrial and industrial purchasers. Vigour offers voltages emerge as distorted as a consequence of the immoderate stage of undesired harmonic present drawn from the utility. Furthermore, drops in the principal voltage are precipitated through the interplay between the reactive present and community impedances. Renewable Energy resources are being increasingly linked in distribution methods using vigour digital converters. This paper grants a novel manipulate method for accomplishing the very best advantages from these grid-interfacing inverters utilizing the closed loop fuzzy good judgment manage when connected in three-phase 4-wire distribution ways. The grid interfacing inverter can simply be utilized to participate in following features similar to change of energetic source harvested from the renewable assets, load reactive energy demand support, present harmonic compensation at %And present unbalance and impartial current compensation in case of three-phase 4-wire strategy. In this paper PI controller and fuzzy customary sense, controller is used personally for controlling the DC capacitor voltage. The grid interface inverter configuration with IGBT is designed and the picture items of the Grid interfacing inverter is developed using the MATLAB/SIMULINK.

Keywords: IGBT, FUZZY CONTROLLER, PCC, inverter, power quality.

1. INTRODUCTION

Power digital converters, ever before a lot more extensively made use of in commercial, industrial, and also residential applications, struggle with the trouble of attracting non-sinusoidal existing as well as responsive power from the resource. This practices creates voltage distortion that influences various other lots linked at the very same factor of typical combining. Electric Power high quality is a term which has actually caught raising focus in power design in the current years, the step of power high quality relies on the demands of the tools that is being provided. What is great power top quality for an electrical motor might not be great

sufficient for a computer. Normally the term power top quality describes keeping a sinusoidal waveform of bus voltages at ranked voltage as well as regularity. The waveform of electrical power at generation phase is simply sinusoidal as well as devoid of any kind of distortion. Much of the Power conversion and also intake tools are likewise developed to work under pure sinusoidal voltage waveforms. Nevertheless, there are lots of gadgets that misshape the waveform. These distortions might proliferate around the electric network. Over the last few years, there has actually been a boosted use non-linear tons which has actually led to a raised portion of non-sinusoidal currents as well as

voltages in Electric Network. The power digital modern technology plays a popular duty in dispersed generation and also assimilation of RES right into electric grid. It is one of the most routine issues when linking tiny RES to the electrical grid which is the user interface device in between the source of power and also the grid due to the fact that it can infuse harmonic elements that might deteriorate the power top quality. Nonetheless, the enormous use power electronic devices based devices as well as nonlinear loads at PCC produce harmonic currents, which might deteriorate the top quality of power. To manage the inverter as though to optimum make use of Renewable power with grid a standard PI control technique exists in paper [1] Energetic Power Filters (EPF) is significantly made use of to make up present harmonics and also tons unbalance. The Active power filter geography [2] can be attached either in collection or shunt or additionally in mix of both. The grid-interfacing inverter can successfully be used to do features as transfer of energetic power gathered from the renewable energies (wind, solar, and so on), tons responsive power need assistance, present harmonics payment at PCC, existing unbalance as well as neutral existing settlement in instance of 3-phase 4-wire system. In addition, with sufficient control of grid-interfacing inverter, all the 4 goals can be completed either independently or at the same time. The PQ restrictions at the PCC can as a result be purely preserved within the energy requirements without added equipment expense.

2. RELATED STUDY

Renewable energy source (RES) integrated at distribution level is termed as

distributed generation (DG). The utility is concerned due to the high penetration level of intermittent RES in distribution systems as it may pose a threat to network in terms of stability, voltage regulation and power-quality (PQ) issues. Therefore, the DG systems are required to comply with strict technical and regulatory frameworks to ensure safe, reliable and efficient operation of overall network. With the advancement in power electronics and digital control technology, the DG systems can now be actively controlled to enhance the system operation with improved PQ at PCC. However, the extensive use of power electronics based equipment and non-linear loads at PCC generates harmonic currents, which may deteriorate the quality of power. Grid-connected three-phase photovoltaic (PV) systems are nowadays recognized for their contribution to clean power generation. A primary goal of these systems is to increase the energy injected to the grid by keeping track of the maximum power point (MPP) of the panel, by reducing the switching frequency, and by providing high reliability. In addition, the cost of the power converter is also becoming a decisive factor, as the price of the PV panels is being decreased. This has given rise to a big diversity of innovative converter configurations for interfacing the PV modules with the grid. Generally, current controlled voltage source inverters are used to interface the intermittent RES in distributed system. Recently, a few control strategies for grid connected inverters incorporating PQ solution have been proposed. In an inverter operates as active inductor at a certain frequency to absorb the harmonic current. But the exact calculation of network inductance in real-time is difficult and may deteriorate the

control performance. A similar approach in which a shunt active filter acts as active conductance to damp out the harmonics in distribution network is proposed in a control strategy for renewable interfacing inverter based on – theory is proposed. In this strategy both load and inverter current sensing is required to compensate the load current harmonics. The non-linear load current harmonics may result in voltage harmonics and can create a serious PQ problem in the power system network. Active power filters (APF) are extensively used to compensate the load current harmonics and load unbalance at distribution level. This results in an additional hardware cost. A voltage-source converter is a power electronic device that connected in shunt or parallel to the system. It can generate a sinusoidal voltage with any required magnitude, frequency and phase angle. The VSC used to either completely replace the voltage or to inject the „missing voltage“. The „missing voltage“ is the difference between the nominal voltage and the actual. It also converts the DC voltage across storage devices into a set of three phase AC output voltages. In addition, Proposed Converter is also capable to generate or absorbs reactive power. If the output voltage of the VSC is greater than AC bus terminal voltages, proposed converter is said to be in capacitive mode. So, it will compensate the reactive power through AC system and regulates missing voltages. These voltages are in phase and coupled with the AC system through the reactance of coupling transformers. Suitable adjustment of the phase and magnitude of the proposed converter output voltages allows effective control of active and reactive power exchanges

between proposed converter and AC system. In addition, the converter is normally based on some kind of energy storage, which will supply the converter with a DC voltage.

IN PV SYSTEM:

Solar energy is also one of the important renewable energy sources. Photo voltaic (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels comprising a number of cells containing a photovoltaic material . There are different Tracking systems available for the solar panels. To get solar power more efficiently a Maximum Power Point Tracker (MPPT) is used that functions the photovoltaic (PV) modules in a way that allows the PV modules to produce all the power they are capable of. It is not a mechanical tracking system which moves physically the modules to make them point more directly at the sun. Since MPPT is a fully electronic system, it varies the module's operating point so that the modules will be able to deliver maximum available power. As the outputs of PV system are dependent on the temperature, irradiation, and the load characteristic MPPT cannot deliver the output voltage perfectly. For this reason MPPT is required to be implementing in the PV system to maximize the PV array output voltage. This thesis focuses on the grid-interfacing architecture, taking into account how to interconnect Distributed Generation systems (DG systems) in the future grid with enhanced voltage quality. The desirable approach should be able to maintain high-quality power transfer

between Distributed Generation system and the utility grid, and be able to improve the voltage quality at both user and grid side.

3. AN OVERVIEW OF PROPOSED SYSTEM

As a result of proceed utilizing Fossil Fuel to create Electrical power enhancing air contamination, worldwide warming problems, reducing non-renewable fuel sources as well as their boosting price have actually made it essential to look in the direction of Renewable Energy Sources (RES) as a future power service. Given that minority previous years, to conquer these dilemmas several nations on renewable resource for power generation. The federal government's offers numerous motivations to increase the renewable resource field development. Renewable resource Sources require progressively at the circulation degree as a result of enhance in lots need which use power digital converters. Because of the huge use power digital gadgets, disruptions take place on the electric supply network. These disruptions result from non- direct tools. These will certainly create harmonics in the power system consequently triggering devices over home heating, damages tools, EMI relevant troubles and so on. Energetic Power Filters (APF) is made use of to make up the present harmonics as well as lots unbalance. In this job existing the brand-new control technique to manage the inverter as though to optimal uses Renewable power with grid. Energetic power filter is made use of makeup harmonics tons unbalance. Present regulated voltage resource inverter is utilized to user interface the Renewable power resource in dispersed system. This

job provide a brand-new technique that includes 4 leg VSI with brand-new control approach is qualified to making up issues like power aspect, present inequality as well as present harmonics, boost power top quality as well as infusing renewable resource to grid with a reduced THD. Shunt energetic power filter is utilized to make up lots existing harmonics by infusing equivalent yet contrary making up existing. In this task 3 stage 4 cable voltage resource present regulated inverter is utilized. Normally 3 cable inverter is utilized however in this 4th terminal is utilized to make up the neutral present. A voltage resource inverter is transform eco-friendly DC power right into A/c with needed size, stage angle as well as regularity. It additionally transforms the DC voltage throughout storage space gadgets right into trine stage Air Conditioning outcome voltages. It is likewise qualified to create or takes in responsive power. If the outcome voltage of the VSC is above AC bus incurable voltages, is stated to be in capacitive setting. So, it will certainly make up the responsive power via A/C system. The sort of power button made use of is an IGBT in anti-parallel with a diode. The 3 stage 4 leg VSI is designed in Simulink by utilizing IGBT. The driving voltage throughout the inductance identify the optimum di/dt that can be accomplished by the filter. A big shutoff of inductance is much better for seclusion from the power system and also security from short-term circulation it likewise restrict the capacity of the energetic filter to terminate greater order harmonics. If the lots attached to the PCC is non-linear or out of balance or the mix of both, the offered control technique additionally makes up the harmonics,

unbalance, and also neutral present. The obligation proportion of inverter buttons are differed in a power cycle such that the mix of lots and also inverter infused power looks like well balanced resisting tons to the grid. The law of dc-link voltage lugs the details relating to the exchange of energetic power in between sustainable resource as well as grid. Hence the result of dc-link voltage regulatory authority causes an energetic existing (IM). The reproduction of energetic existing part (IM) with unity grid voltage vector themes (UA, UB as well as UC) creates the recommendation grid currents (IA *, IB * and also IC *). The referral grid neutral existing (IN *) is readied to absolutely no, being the instant amount of well balanced grid currents.

$$U_A = \sin \theta$$

$$U_B = \sin(\theta - \frac{2\pi}{3})$$

$$U_C = \sin(\theta + \frac{2\pi}{3})$$

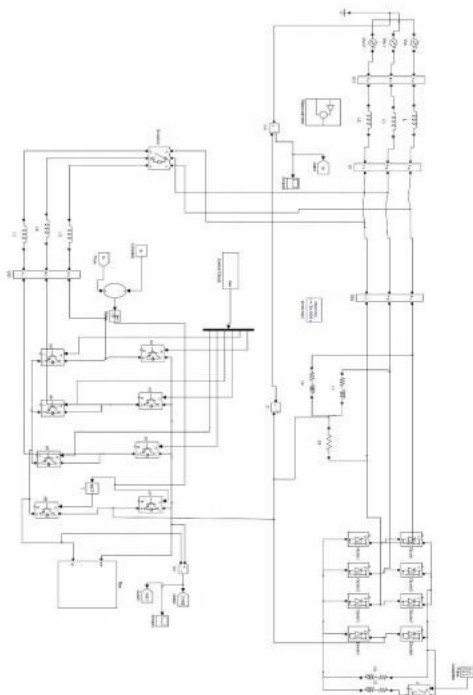


Fig.3.1. Proposed system simulation diagram.

This method controls the switches of the voltage source inverter asynchronously to ramp the current up and down ,so that it follows the reference current. Hysterisis current control method is the easiest control method to implement in the real time. Fig 4 illustrates the ramping of the current between the two limits where the upper limit is the sum of the reference current and the maximum error or the difference between the upper limit and the reference current and for the lower hysteresis limit, it is the subtraction of the reference current and the minimum error. Fig. shows the hysteresis current controller. According to the operating principle of the inverter, the output voltagess of the each phase are significant to the switching pulses of the switches in each leg. As a result, the switching gates for the active power filter can be obtained. The switching pattern of each IGBT inside inverter can be formulated on the basis of error between actual and reference current of inverter.

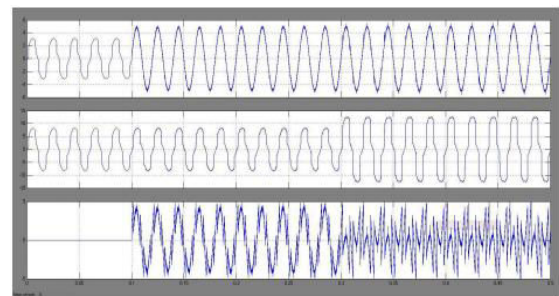


Fig.3.2. In single phase output at inverter.

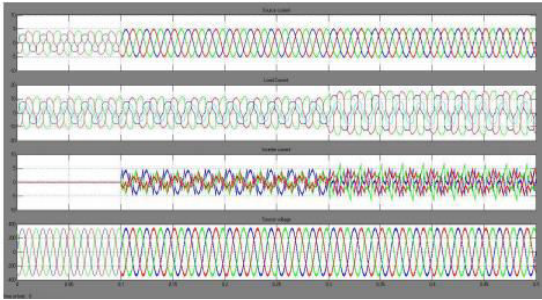


Fig.3.3. In three phase output.

THD of grid currents are decreased up to 1.89% and settling of the system is improved hence the PI controller has fast response, high accuracy of tracking the DC-voltage reference, and strong robustness to load sudden variation.

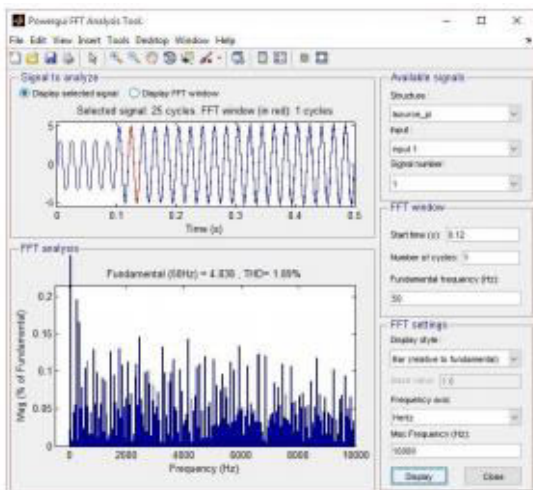


Fig.3.4. THD value by using PI controller.

BY USING FUZZY LOGIC CONTROLLER:

The word Fuzzy means vagueness. Fuzziness occurs when the boundary of piece of information is not clear-cut. In 1965 Lotfi A.Zahed propounded the fuzzy set theory. Fuzzy set theory exhibits immense potential for effective solving of the uncertainty in the problem. Fuzzy set theory is an excellent mathematical tool to handle the uncertainty arising due to vagueness. Understanding human speech and recognizing handwritten characters are some common instances where fuzziness

manifests. Fuzzy set theory is an extension of classical set theory where elements have varying degrees of membership. Fuzzy logic uses the whole interval between 0 and 1 to describe human reasoning. In FLC the input variables are mapped by sets of membership functions and these are called as “FUZZY SETS”

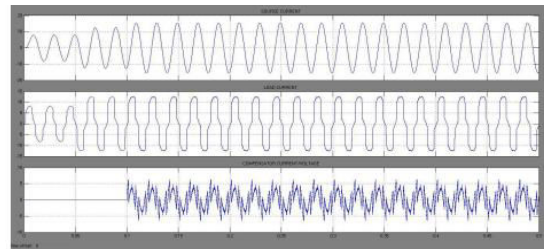


Fig.3.5. single phase output by using FLC controller.

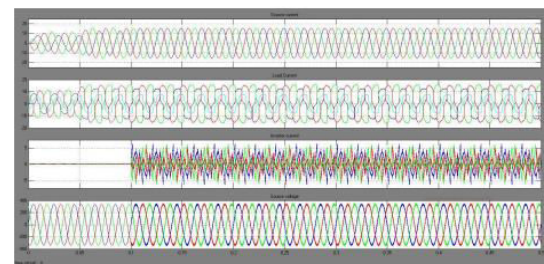


Fig.3.6. three phase output by using FLC controller.

THD of grid currents are decreased up to 1.45% and settling of the system is improved hence Proposed FUZZY controller has fast response, high accuracy of tracking the DC-voltage reference, and strong robustness to load sudden variation.

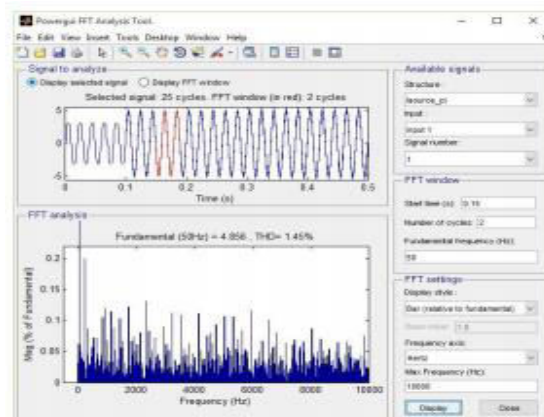


Fig.3.7. THD value by using FLC controller.

4. CONCLUSION

This project provides a power quality improvement in grid connected renewable energy at distribution by using three phase four wire inverter. The inverter is mainly used to DC to AC at desired voltage level of the grid. Harmonics level of supply current is 16.73% without filtering, after implementing filter (inverter) the harmonic level is reduced to 1.89%. The grid interfacing inverter inject real power from RES and effectively utilized at lagging demand. The neutral current is prevented to flow to the grid this is done by fourth leg of inverter to compensate neutral current as nearly equal to Zero. The THD level of the grid current is reduced hence improve the power quality. It is future demonstration the Power quality under three different conditions. PRES=0, PRESPL. The current unbalance, harmonics at distribution level, and active power support due to unbalance load connected to the distribution system.

REFERENCES

- [1] Roshan Haste, Power Quality Improvement in Grid Connected Renewable Energy Sources at Distribution Level, 2014 International Conference on Circuit, Power as well as Computing Technologies [ICCPCT]
- [2] Mukhtiar Singh, "Grid Interconnection of Renewable Energy Sources at the Distribution Level with Power-Quality Improvement Features", IEEE deals on power distribution, vol. 26, no. 1, January 2011.
- [3] Roshan Haste, "Power Quality Improvement in Grid Connected Battery Storage Energy Source at Distribution Level", ISSN 2231- 1297, Volume 4, No 1, pp. 27-34, 2014.
- [4] M.El-Habrouk, M. K. Darwish and also P. Mehta," The Active power filters: An evaluation" IEEE process on Electric power applications, Vol 147, No. 5, pp 403 - 413, September 2000.
- [5] Hingorani, "Introducing Custom Power" IEEE Spectrum, Vol.32, No. 6, pp: 41-48, June, 1995.
- [6] Afshin Lashkar Ara as well as Seyed Ali Nabavi Niaki, "Comparison of the Facts Equipment Operation in Transmission and also Distribution Systems", 17th International Conference on Electricity Distribution Barcelona, Session No. 2, Paper No. 44, pp:12 -15 May 2003.
- [7] K. R. Padiyar, "Facts Controllers in Power Transmission and also Distribution", New Age International Publishers, 2007.
- [8] T.R. Ayodele, A.A. Jimoh, J.L Munda, J.T Agee," Challenges of Grid Integration of Wind Power on Power System Grid Integrity: A Review" in International Journal of Renewable Energy Research T.R. Ayodele et al., Vol.2, No. 4, 2012.
- [9] Haroon Ashfaq, Surendra Kumar Tripathi," Wind Energy Conversion System Integrated with Grid under Variable Speed Scenario", International Journal of Advanced Research in Electrical, Electronics and also Instrumentation Engineering Vol. 4, Issue 2, February 2015.
- [10] V. Ilavarasi, C. Christofer a. Rajan, "Power top quality Improvement in Grid attached" Grid Connected Renewable Energy System with Power Quality Improvement making use of 4 leg VSI", offered at IEEE conf. on Advances in engg, Science and also Management, March, 2012.

[11] J. P. Pinto, R. Pregitzer, L. F. C. Monteiro, as well as J. L. Afonso, "3-phase 4-wire shunt energetic power filter with renewable resource user interface," offered at the Conf. IEEE Renewable Energy & Power Quality, Seville, Spain, 2007.

ABOUT AUTHOR:



P.HARIKA working as assistant professor in ANURAG COLLEGE OF ENGINEERING college and completed M.Tech in the stream of Power Electronics at Nishitha college of Engineering and Technology in the year of 2018.