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A Review onDesign and Analysis of a UPQC Power Flow Control Using Distribution Transformer

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***Abstract*-The current power sector is dealing with the poor power quality issues and the reason behind this poor power quality is voltage fluctuations, harmonics, transients and reactive power demands and these problems arises due to changing trend of our demand. Nowadays in our demand the share of power from power electronic devices has increase a lot and also coupling of grids to wind farms and solar farms has raised the problem of poor power quality.[25] No doubt series and shunt compensations are effective but if they are used simultaneously as a unified unit, this enhances the effectiveness of the device and becomes more beneficiary for power sector and they are used together as UPQC. So the main task of UPQC is to improve the power quality and it proves out to be quite good at that by compensating the above mentioned problems. Hence UPQC is considered as the efficient solution of the power quality problems. As the UPQC serves purpose of both series and shunt compensators, hence to provide this it contains two inverters, which are voltage source inverters with common DC link. These are called series and shunt converters. These controllers can be controlled by various techniques such as PI controllers, FUZZY controllers, Neural Networks etc .Shunt converter compensates the distortion in load current and the series converter is responsible for smoothening of voltage.**

***Keywords*-Power Quality, UPQC, voltage sag, voltage swell, FACTS, DVR, STATCOM.**

I.INTRODUCTION

The main motive of power distribution systems is to provide uninterrupted power to the consumers with supply being purely sinusoidal and acceptable frequency but the same is not fulfilled because of non linear loads, implementation of power electronic devices as loads and clubbing of power from different sources [1].Apart from these above mention loads harmonics and transients arises due to abrupt switching of heavy appliances such as sudden shut down of generators of connection a generator to the transmission line without synchronizing its output to the grid or taking out transformers from the circuit cause such problems.

The poor power quality hampers the growth as the most affected are the industries which totally rely on electricity and due to substandard power quality of power the efficiency of machines reduces hence the output decrease. The problems subjected to transmission and distribution can be bifurcated into power quality and power reliability. Impulses, swells and harmonic distortion are included in power quality and power reliability comprises of voltage sags and outages [2]. Also the harmonics in the power supply cause interaction with communication signals and cause distortions in communication signals and these high frequency harmonics cause insulation failures [3]. We can remove power quality problems by implementing FACTS devices in the system but in FACTS devices UPQC is found to be quite efficient in improving power quality as it have series and shunt converters which mitigate both current and voltage based power quality problems simultaneously.

II.LITARATURE REVIEW

The aim of this chapter is to develop background knowledge and briefly discusses about the recent development in the unified power quality conditioner. This chapter begins with system configuration and detailed description on the operating principle of the UPQC.

Later on in this chapter, a systematic literature survey on UPQC is presented. From the survey, it is found that the UPQC is a promising versatile compensating device among custom power devices for simultaneous compensation of voltage and current related power quality (PQ) distortions [3]. And a detailed study was carried on the role of series and shunt active power filter (APF) and classification of UPQC based on supply system and converter topology. An interesting analytical study was done on how the UPQC could compensate the PQ distortions under different operating conditions. The extraction of fault-relevant signal characteristics can, in many cases, be restricted to the amplitudes or amplitude densities within a certain bandwidth of the signal using

band pass filters. The parametric signal models which allow the main frequencies and their amplitudes to be directly estimated and which are especially sensitive to small frequency changes can also be used. Model-based methods of fault detection use the relationship between several measured variables to extract information on possible changes caused by faults. These relations are mostly analytical in the form of process model equations but can also be causalities.

The two methods of fault diagnosis are: classification method (without structural knowledge) and inference method (with structural knowledge). Classification methods are used when structural knowledge is available between the symptom and fault. These methods include Bayes classifier (based on the statistical distribution of the symptoms), decision trees (based on series of questions to be answered for the cause of fault), polynomial classifier (functional approximation of the classes based on particular fault), geometric classifier (based on the determination of the membership class of a data point from its distance to reference point) and neural network classifier[4-5].

The parity relations and the diagnostic observers require an accurate model of the system for fault diagnosis whereas the parameter estimation methods require only the structure of the system model. In many cases the process models are not known at all or only some parameters are known. Therefore, the parameters are identified first before applying any model based fault detection method. The parameters are estimated by measuring input and output signals if the basic model structure is known. Early publications known on fault detection with parameter identification methods include those by Bakiotis et al (1979) and Isermann (1982). The parameters of the model are estimated and compared to their values during normal operating conditions. Many methods are available for estimating the parameters namely, recursive least square method, square root filtering, stochastic approximation, extended least square and maximum likelihood method. These methods use iterative procedures and are precise under the influence of process disturbances. The features of parameter estimation method are given below:

- The model structure must be known.
- Especially suitable for multiplicative faults and additive faults on the input and output signal.
- Several parameter changes are uniquely detectable.
- Very small changes are detectable, which includes the detection of slowly developing as well as fast developing faults.
- Online real time application is possible for processes which are not very fast.
- Input excitation is required for dynamic process parameters.

When the basic relationship between faults and symptoms is partially or fully known in the form of causal relations, the inference method of fault diagnosis is employed. Fault tree is an inference method of fault diagnosis apart from neural network and fuzzy based techniques. The symptoms and events are considered as binary variables and the condition part of the rules are evaluated by Boolean equations. However, the fault tree is not a popular method because of the continuous nature of fault and symptoms. In this work, inference method based on AI techniques is used for fault diagnosis.

In recent decades, there have been various proposals for stability. Many research works have been implemented to improve this. But, the requirement of this work is not so easy. So, the development in this industry continues. Artificial intelligence techniques give their best in achieving stability.

Distributed generator protection standards have certain alterations from traditional radial utility systems that posture technical challenges to the protection engineer and security concerns for the Self-governing Power Producer and customers. This chapter holds a review of protection concepts for: distributed generators, how islanding detection fits into the protection mix, a description of typical measurement systems and a review of previous work on distributed generator islanding detection. Distributed generators are low voltage small electrical sources (typically less than 30 MVA) located in or near the customer loads, and like all other generators, they require electrical protection from short circuits and abnormal system conditions. Some of these abnormal conditions are caused by the utility system itself, such as, over voltages, unbalanced currents, abnormal frequency, and breaker reclosures [5] [4] [6] [7] [3].

These conditions can happen very quickly causing generator failure and are of great concern to the owner of the distributed generator. Similarly, the utility is concerned that installations of distributed generators will result in problems on the utility‘s distribution equipment or to the customer loads. Though each utility will have their own specific guidelines according to the characteristics of each particular region, there are several international standards available that can be used as guidelines. The most important four are as follows [4]:

- IEEE C37.95-2003 IEEE Guide For Protective Relaying of Utility-Consumer Interconnections [15]
- IEEE 929-2000 Recommended Practice for Utility Interface of Photovoltaic (PV) Systems [90]
- Power Line Carrier Communications [6] [8]
- Transfer Trip
- Supervisory Control and Data Acquisition (SCADA) Passive Islanding Detection Methods • Under/Over Voltage (Relay 59, 27)
- Over/Under Frequency (Relay 81)

- Voltage Phase Jump / Voltage Vector Shift / Frequency Phase Jump Relay
- Detection of Voltage and/or Current Harmonics
- Rate of Change of Frequency Relay (ROCOF)
- Rate of Change of Voltage
- Rate of Change of Real/Reactive Power and Power Factor
- Signal Produced By Disconnect
- Voltage Unbalance [5] [2] Active Islanding Detection Methods
- Slip-mode Frequency Shift
- Frequency Bias
- Sandia Frequency Shift
- Sandia Voltage Shift
- Frequency Jump
- ENS or MSD (A device using multiple methods) [6]
- Varying Terminal Voltage/Voltage Pulse
- Reactive Error Export
- Voltage Unbalance [4]
- Impedance Monitoring (See section 2.4)

1. General

This chapter provides an outline of the relevant technical literature related to the present study. It explains the recent research works and how the research has done.It explain the drawbacks of their works also. The latest trend in recent research work is to tune and set the optimal location of FACTS devices.It has been explained in detail by researchers. It is noted in this chapter.

2. Background Study

The use of neural network for identification of parameters has been reported by Chu et al (1990); Narendra et al (1990). Bernieri (1994) has used a dynamic multilayer neural network for parameter estimation in a secondorder lead-lag bandpass filter. The network is trained for normal and different fault conditions based on the parameters obtained from system transfer function during the steady state conditions.

Sorsa et al (1993) have used a bank of neural network models (each for known class of system behaviour) that is similar to observer based schemes. The neural network replaces the analytical model that describes the process and the models are developed with appropriate data for different system behaviour.

Han et al (1997) have proposed a parameter estimation technique using neural networks in which the physical parameters are estimated by applying the neural network universal approximation property with the help of the measured input/output data. The deviations of the parameters from normal values are then used for fault diagnosis. It is assumed that the fault in the mentioned process can be described as changes in the parameter vector and the nominal parameter values are known in advance or can be estimated online. (e.g. via RLS method).

Chen et al (1991) have used neural networks for fault diagnosis through generation of residuals in signal processing application. The fault data are required for all expected faults in terms of residual values or system measurements. A multi-layer feedforward network is trained to represent the relationship between past values of residual data (generated by another neural network) and those identified with some fault condition. The second neural network is used for classification in conjunction with other residual generating methods.

Chandorkar et al. (1993) have worked on the control of inverters in islanded mode alone. Chen et al. (1995) have analysed the combination of voltage and current controlled inverters. Van et al. (1998) have suggested a simple solution to operate the inverters in parallel. In the same way Kawabata et al. (1988) have also advocated the operation of parallel inverters. Hanaoka (2003) presented a method of operating Uninterrupted Power Supply (UPS) in parallel as a redundant unit. Chandrokar et al. (1994) have investigated the method of control of UPS using a new architecture.

Alvaro et al. (1996) have designed an optimal static prefilter for robust performance against Linear Time Invariant (LTI) or Linear Time Variant (LTV) structured uncertainties using the H∞ and Hz performance index. These are convex problems and they fall into the scope of well-known optimization algorithms.

Gomm (1998) has described an adaptive neural network that continuously monitors the process and improves its performance online as new fault information becomes available. New nodes are automatically added to the network to accommodate novel process faults after detection and online adaptation are achieved using recursive linear algorithm to train selected network parameters.

Patton et al (1999) have proposed a model of fault detection without residual generation. A single layer neural network used for fault detection accepts current and past inputs [u(k), u(k-1), u(k-2) …] and current and past values of output [y(k), y(k-1), y(k-2) …]. The network directly indicates the occurrence of fault at the output. As an alternative Bhama et al (1993) have proposed a technique for identifying the parameters A and B of an unknown second-order dynamic system. The author has used a Single Layer Neural Network (SLNN) that uses a gradient descent learning algorithm (also known as instant back propagation) to train and identify the parameters of a linear Single-Input Single-Output system (SISO), where the weights of the network represent the system parameters. The modified gradient descent learning algorithm proposed by Yadaiah et al (2000) works well in terms of faster convergence irrespective of the initial conditions where online identification can be done. 19 Chi-Sing Leung et al (2001)

have Chi-Sing Leung et al (2001) have used RLS based algorithm for online training of the multilayer feedforward neural network. It has been shown through simulation result that the trained network has improved generalization capability. Yong et al (2006) have proposed a generalised RLS model which includes a general decay term in the energy function for the training of feedforward neural network for four different problems. In this work a single layer neural network is used to obtain the system parameters for deaerator which is a Multi-Input Multi-Output system, using the RLS algorithm.

Nayan et al. (2014) have detailed the technique for the identification of weak bus and voltage stability enhancement. The weakest bus is identified using sensitivity indicator method which is very simple and fast as it neglects the effect of power angle. Based on this method, the amount of reactive power to be injected at the load bus to avert the voltage instability as the load on the load bus increases is calculated.

Ali ahmadian et.al (2014) have given a unique method for output response damping controller strategy of the static synchronous compensator (STATCOM) to boost the damping of power system low-frequency oscillations (LFO). The time domain-based objective function is resolved by a Honey Bee Mating Optimization (HBMO) algorithm which has a powerful skill to search out essentially the most optimistic outcomes. The usefulness of the proposed controller is examined and demonstrated via Eigen value evaluation.

Mohsen gitizadeh et.al (2014) have proposed a research work to improve power system stability in extended transmission lines. Two targets are analyzed on this paper to enhance the transient steadiness of the system and the SVC asset value. On this examine, the precise model of the lengthy transmission line is taken into account to precisely decide the SVC location. Through the use of the exact model of the line for lengthy transmission strains, the SVC asset value is diminished and the outcomes have extra accuracy than that discovered when the simplified model was used.

Mohsen gitizadehl et.al (2014) have proposed to enhance the power system steadiness in a multi-machine power structure. Although power system stabilizers are obligatory necessities for damping of fluctuations, its efficiency nonetheless will get affected by modifications in network configurations. Nonetheless, the efficiency of SVC extremely relies upon its constraints, appropriate location, and sizes within the energy network. With the intention to discover the answer, this drawback is expressed as a multiobjective operates. Multi-Objective Particle Swarm Optimization (MOPSO) is practiced to seek out one of the best solutions. In this paper, two targets are discussed to enhance each the transient steadiness of the system and the SVC funding price. The proposed technique was examined on the 10-machine 39-bus bar New England takes a look at the system.

Sandeepgupta et.al (2015) have proposed a Current Source Converter (CSC).It has a significant position as a secure assist for insignificant and enormous transitory instability in an interconnected energy community. A sturdy linear quadratic regulator (LQR) primarily founded controller for CSC-STATCOM is proposed. On this analysis work, LQR primarily constructed CSC-STATCOM is considered to reinforce the transient stability of two-region two-machine energy system.

Merveguleryuzhalacli et.al (2016) have suggested voltage steadiness evaluation of a real power system subjected to a big disturbance by a mix of static and dynamic methodologies. Within the first a portion of the research, the system is scrutinized for each regular operation and eventualities through the use of static evaluation tool by which Continuation Power Flow method (CPF) is carried out. Nevertheless, the motion of the STATCOM is instantly influenced by the right functioning of the controller. Unsuccessfully tuned STATCOM controller ends in voltage oscillations. The tuning downside of the STATCOM is transformed into a smart downside which diminishes the voltage deviances. Particle swarm optimization (PSO) method is utilized in this paper to tune the parameters of the STATCOM.

Sun hongchan et.al (2016) have proposed a 5.6 kV seventeen-level STATCOM for reactive power compensation. By utilizing the phase-shifted service modulation technique and the active-reactive current decoupling methodology, the STATCOM makes fairly effectively. Furthermore, the modulation technique of the 17-level STATCOM constructed mostly on the Automatic Disturbance Rejection Control (ADRC) is introduced and the analytical formulation is designated. For execution, management techniques for DC bus voltage steadiness in cascaded H-bridge multilevel converters, time common distribution methodology and excessive worth offset methodology are utilized in the design.

Tomohiro adachi et.al (2016) have suggested a management structure of the DFIG and analyze its impact on the small-signal steadiness of the facility system by Eigenvalue designs and time-domain simulations. Various wind turbine generations have been put into energy techniques around the globe, the place in recent times doubly fed induction generator (DFIG) fascinates plenty of attention due to its affectivity and controllability. Nonetheless, the DFIG is linked to the facility system by way of inverters and initially doesn't have a capability to launch the kinetic power of the rotor because of the kinetic power. Subsequently, it has not been finished clear how the DFIGs have an effect on small-signal stability in power techniques.

Na deng et.al (2016) have proposed a DC current circulation controller which might present division current management in a engaged multi-terminal High-Voltage Direct Current (DG) grid. Nonetheless, the outline of a DC current circulation controller might have an effect on the steadiness of the multi-terminal DG. Based mostly on the steadiness evaluation of the small-signal model, a management system is planned for the DC current circulation controller which fulfills the system stability requirement.

Ahmed M. Kassem et.al (2017) have proposed the applying of firefly optimization algorithm to plan optimum management for voltage steadiness of a stand-alone hybrid renewable technology unit based mostly on reactive power management. The renewable technology unit primarily contains of an eternal magnet induction generator run by the wind turbine and a synchronous generator run by a diesel engine. The primary management goal is to steady the terminal load voltage towards any troubles that are completed by controlling STATCOM section angle. The proposed renewable vitality energy system constructed mostly on the projected optimum controller has been examined via a step change in entering wind energy and load reactive energy.

Motoki sano et.al (2017) have proposed a novel islanding detection methodology named Novel Islanding Detection Methodology is broadly geared up with grid-tied photovoltaic era programs (PVs) to precisely sense their islanding operation. Nonetheless, some analysis outcomes present that the intensive set up of latest islanding detection methodology which carries adverse influences on the steadiness of major energy grids. It is because of the islanding detection methodology which has a chance to detect frequency variation brought on by the principle grid's faults. The authors particularly give attention to a frequency suggestions mechanism within the islanding detection methodology after which make clear some effects on the steadiness of major grids that are originated from the expansion in saturation of the islanding detection methodology in PVs.

Arifiqbal et.al (2018) have addressed the steadiness evaluation of a six-phase synchronous motor throughout steady-state process utilizing Eigen value standards from its resultant linearized model. Based mostly on the difference of dominant Eigenvalues, an area of uncertainty is decided beneath totally altered parametric variation and dealing situations. Outcomes set up a preferable methodology for motor steadiness at its project stage in addition to beneath regular working situations. Evaluation has been carried out through the use of the method of Park's transformation in a MATLAB atmosphere along with some investigational outcomes.

J Sreedevi, Ashwin N (2016) Photovoltaic (PV) energy has a fast growing annual rate and is quickly becoming an important part of the energy balance in most regions and power systems. This paper aims to study the effects of connecting a PV system to the grid through simulation of the system in RSCSD software in real time on the Real Time Digital Simulator (RTDS). Effect of variation of power factor of loads, variation of PV penetration, and introduction of harmonics into the system by the PV inverter and anti-islanding effect of the PV system are studied. Finally, the Performance Ratio (PR) of a typical grid connected PV system is evaluated to determine the reliability and grid connectivity of the PV system [1].

Dhanshree A. Diyewar (2016) One of the major drawback of connecting PV systems to the grid is unintentional islanding condition. Islanding can be dangerous for utility workers and damage utility equipment so anti islanding is a crucial subject for grid connected PV systems. For this reason inverter in the PV system must detect islanding and stop supplying power if the grid is down. In this paper 12 pulse Lee is used in inversion mode for the grid connection of PV system. A 12 pulse Lee converter needs com mutating voltage of grid to operate. The Lee do not require maintaining synchronism between grid and converter and having an ability to suppress all harmonics below 11 th order. The simulation results is carried out in Matlab/Simulink shows feasibility of proposed solution [2].

Prashant Jain, Vivek Agarwal (2018) This paper presents an active anti-islanding scheme for grid-tied centralized inverters for large Photovoltaic (PV) power plants. The proposed technique involves appropriate reactive power injection into the grid which results in the positive/negative rate of change of frequency. The proposed algorithm is simple and can be easily integrated into DQ based current control technique. It has a smaller Non-Detection Zone (NDZ) and faster response as compared to other active anti-islanding schemes. As the proposed method is based on alarm generation and confirmation, it does not inject any periodical disturbance into the grid unlike other anti-islanding techniques and thus does not cause any power quality issues. The proposed active anti-islanding algorithm is simulated in MATLAB/SIMULINK under different loading conditions as per IEEE/IEC standards. The algorithm is also experimentally verified on a 25 kW centralized inverter prototype using TMS320F2812 DSP controller. The experimental and simulation results are presented to validate the effectiveness of the algorithm [3].

Ahmed M. A. Haidar, Al-Khalid bin Hj Othman (2017) The widespread adoption of Renewable Energy Resources (RER) and Plug-in Electric Vehicles (PEVs) in distribution systems has achieved a substantial energy share, allowing the microgrid to participate in the open market. In fact, the high penetrations of RER and PEVs have increased the importance of impact assessment involving system protection. A framework is presented in

this paper for modeling the combined operations of RER based solar Photovoltaic (PV) systems and PEVs in a microgrid integrated with power grid. The paper also proposes a fault current limiter connected in parallel (anti-islanding protection) with the circuit breaker in the point of common coupling (PCC), thus providing current bypass circuit during abnormal conditions. The concept of the proposed scheme is validated under various operating conditions using a 24-hourly dynamic simulation. The results demonstrate the effectiveness of the proposed approach [4].

Jongmin Jo, Hanju Cha (2017) In this paper, reactive power variation based on positive feedback is proposed for improving islanding detection in the distributed generation. The proposed reactive power variation method consists of two parts, where the first part has a fundamental amplitude as +5%Pinv or -5%Pinv, and the second part has a positive feedback using a frequency deviation. Polarity and amplitude of RPV method are determined by a deviation between the measured frequency at PCC and the rated frequency. For grid-connected operation, the amplitude corresponding to the positive feedback can be ignored since there is almost no frequency deviation. Therefore, an only +5%Pinv or -5%Pinv is supplied to loads, and either positive or negative value may be switched by the measured frequency. Power factor is close to unity power factor as 0.9975.

In islanding condition, the positive feedback affects changes of PCC frequency by increasing the absolute amplitude of RPV. Therefore, it makes PCC frequency deviate outside maximum or minimum threshold value rapidly. The direction of PCC frequency toward either maximum or minimum threshold value is determined in accordance with the polarity of the reactive power injected at the time of occurrence of islanding. Feasibility of the proposed RPV method is verified through experiments, where the detection times of islanding take 53ms in over-threshold value as 60.5Hz and 150ms in under-threshold value as 57Hz, respectively [5].

Daniel Motter, José Carlos M. Vieira (2016) The anti-islanding performance of the frequency protection is strongly affected by the power imbalance between the islanded loads and distributed generators. However, different scenarios of load profiles can create similar power imbalance levels inside the island, leading to different protection's detection time due to the difference on the load dynamic behavior. In this context, this paper investigates the influence of the variation of the load distribution, power factor and unbalance on the performance of an over frequency protection applied for islanding detection of a synchronous distributed generator. The results were obtained considering excess of active power in the island and constant impedance loads and they have shown that the performance of the protection scheme can be strongly affected by these load variations, and such issue should be taken into account to correctly adjust the frequency-based ant islanding protection [6].

Zhang Xiaolin, Zhang Zengqiang (2018) With the rapid development of photovoltaic industry, the performance detection of PV grid connected inverter is becoming more and more important in maintaining safe and stable operation, and the capability of anti-islanding is an important aspect of evaluating the performance of grid connected inverter. Based on existing methods and standards for inverter detection, by dividing interval of minimum fundamental wave current at grid connection point and introducing the load resonance frequency as the key test condition, This paper presents a refined detection method of photovoltaic inverter based on RLC circuit impedance characteristics,

such as load resonant frequency and fundamental current variation, and weights comprehensive evaluation of multiple test results on the basis of fine detection. The method proposed in this paper solves the problem that the protection capability of the photovoltaic inverter is difficult to be finely evaluated, and effectively avoids the phenomenon that some inverters can not correctly reflect the capability of the inverter anti anti-islanding for the characteristic load design. This method can comprehensively and objectively reflect the protection performance of the anti-islanding of the inverter. At the same time, it provides technical support for the existing protection performance detection methods of anti-islanding protection, and further enriches and perfects the related standard system of the protection performance detection field of the anti-islanding [7].

Abhijit R. Singare, Bharati Mahindrakar (2017) A photovoltaic system also called solar PV power system is a system designed to supply usable solar power by means of photovoltaic cell. This paper presents a detailed study of Grid-connected photovoltaic system for power supply of institutional building in rural area. The process of acquiring power from PV panels involves a proper selection, design and determination with specifications of various components that are used in the system for confirming the load estimation. The completion of this process depends on different factors such as geographical location of institution, weather condition and solar irradiance at location along with load consumption at the institute. This paper gives complete procedure for specifying each components of the Grid-connected PV system and an institution in Wardha, India is selected for case study. Complete cost analysis which also includes installation and maintenance cost of a solar photovoltaic system has been carried out. It has been observed from the analysis that capital investment is high but payback period is less and after that it will gain consequential profit [8-9].

Kevin Ark Kumar, Kinattingal Sundareswaran (2015) Islanding is a condition in which a portion of electric power grid, containing both load and generation, is isolated from the remainder of the electric power grid. There are two types of islanding conditions- one is an intentional islanding created by the controlling authority to isolate a large section of the utility grid; the other is unintentional islanding, where the utility grid with a distributed generation system (DGS) and its load is alone isolated . The major causes for unintentional islanding are faults, lightning, failure of equipment's, malfunctioning of protective switchgears etc. Among the DGS, majority of the systems are customer-owned generators, like solar photovoltaic systems, wind energy systems etc. As per regulations, these systems are required to sense the islanding condition to close down its operation and should cease to energize the grid A typical line The reasons for cease of operation of an islanded DGS are, to avoid electrical hazard for men-on-line; damage of utility equipments; the frequency and voltage may go out of range that can destroy the customer equipment; islanding may interfere with restoration of normal services to neighbouring customers; customer DGS can be damaged if the main grid recloses into the island out of synchronization [9].

S. Bouchakour, F.CHERFA (2012) Algeria has created a green momentum by launching an ambitious program with an aim of developing renewable energies. This strategic choice is motivated by the huge potential of our solar energy, which is the major focus of the program where solar power and photovoltaic systems constitute an essential part. The use of solar energy should reach by 2030 more than 37% of national electricity production. If it's accomplished, the amount of PV systems in distribution systems is expected to grow and it could become comparable with the power supplied by the main source.

Therefore, PV systems could have serious consequences on important technical aspects such as quality of power supplied to customers by utilities, power control and utility protection schemes, islanding operation of the PV systems. In practice, the utility regulations dictate that PV systems should operate at a power factor greater than 0.85 (leading or lagging), when output is greater than 10% of rating. Thus, power quality caused by a large penetration of PV grid-connected systems becomes an important issue. In this work, the power quality behaviour of grid connected PV systems has been investigated. The solar photovoltaic system power plan, currently in service, was achieved in cooperation with the Spanish Agency for International Development Cooperation (AECID). The installation is located on the roof of CDER in Bouzaréah, Algiers (latitude 36.8°N, longitude 3°E and 345m of altitude). It started operating on June 21, 2004; the electricity produced by photovoltaic solar panels is injected directly into the SONELGAZ grid without storage device [10].

Rami J. Haddad, YouakimKalaani (2018) Distributed Generation (DG) sources have become an integral part of today's decentralized power systems. However, current DG systems are mostly passive and do not provide intelligent information to help detect power quality issues. In this paper, a novel and intelligent event classification scheme is proposed to provide DG systems with real-time decision-making capabilities. The proposed technique has the ability to provide information to help maintain the quality and reliability of DG systems under various disturbances or operating conditions. This event classification technique was developed using artificial neural networks (ANN) with a pre-defined set of local input parameters. The algorithm is implemented using four parallel ANNs that were designed to operate under a majority vote fusion algorithm representing the final classification output. A total of 310 event cases were generated to test the performance of the proposed technique. Simulation results showed that events were accurately classified within 10 cycles of their occurrences while achieving a 96.21% average classification accuracy [11].

MRS.P.S.GOTEKAR: Since the photovoltaic systems development is growing exponentially, the policies related to grid integration will also have to change so that more and more PV systems can be accommodated in the grid. This paper discusses existing Central Electricity Authority (CEA) technical interconnection regulations. As PV penetration increases the CEA can reevaluate the existing operating range for voltage and current factoring the operating conditions in India. Additional features which provide system benefit like reactive power support for an improved voltage profile, intentional islanding, fault ride through capabilities can be thought of. A comparison of transformer less inverters for specific topologies is carried out.

III.RESEARCH GAP

From the review of the existing researchers, the following gaps are identified.

- Coordination among the parallel inverters is very complex when impedances are different.
- Fixed droop coefficients are used which would cause errors in power sharing. Further, it would lead the inverters to operate well below the nominal voltage and frequency.
- Control of parallel inverters during unbalanced grid voltage conditions in a microgrid is not addressed.
- Optimal placement of DG in a best location is not addressed. The above problems are identified with the microgrid for parallel inverters in balanced and unbalanced grid conditions.

IV.PROBLEM FORMULATION

The aim of the current research is to enable the operation and control of the sources connected in a microgrid in a coordinated and efficient way using proposed controller. The main objectives of the research to overcome the difficulties are listed.

- Coordinated of inverters for different scenario
- Improving the power quality during grid disturbances
- Optimal location of Distributed Generation.

V.CONCLUSION

The problems of voltage fluctuation and current harmonics in power system can be reduced with the controlling UPQC. At the point of common coupling the UPQC is connected in order to improve the power quality. As theseries and shunt inverters are working simultaneously the reactive power and voltage compensation takes place. The series inverter provides voltage compensation and shunt provides reactive power compensation. The UPQC is capable of providing a hassle free power supply. We can apply number of controlling techniques as given in paper.

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