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Load Switching Point Changes Tracking and Control using UPQC

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Abstract: **The main objective of this work is to design a system to improve the quality of the network with a simplified architecture to support reactive power as well as to improve the active power available for the load connections and to improve the efficiency of the system controls mentioned above. From this work it was deduced that by developing the inverter system with a control strategy in SVPWM, the network quality improvement device can serve this goal with better results in terms of performance and efficiency. This architecture can also be used in hybrid systems to make them more reliable. The designed system is also suitable for providing various types of load, such as non-linear load, symmetrical load and asymmetrical load.**

Keywords: **PCC, UPQC, PQ, DC.**

I. Introduction

There are power quality issues such as harmonics due to increasing speed of nonlinear loads, as well as power converters such as large thyristors, voltage, rectifiers, and current flickering due to sag, swelling, and arc furnaces due to switching (switching on and off) of loads, etc. these problems are moderately solved by using a passive LC filter. However, such filters cannot correct for a random deviation in the waveform of current and voltage in the loads. Active filters tend to solve such problems. But since active filters are more expensive than cost, it also creates complications in large-scale implementation. Furthermore, they are also less efficient than passive shunt filters. [1].

A. Unified Power Quality Conditioner

Lately, FACTS has emerged as the answer to some QP problems. FACTS The ideas used in spreadsheets ushered in a new era in netting agreements. A UPQC is the expansion of the UPFC idea at the enterprise level. UPQC is the integration of the APF and Shunt-APF series, dynamic power channels connected in series on the DC side and offering a typical DC capacitor.

The UPQC of the series component is responsible for attenuating upstream disturbances: voltage drops/swells, flicker, voltage asymmetry and harmonics. Insert constraints to keep the load constraints at the desired level; balanced and distortion-free. The shunt segment is liable for mitigating the force quality issues brought about by the consumer: low power factor, harmonic load currents, load imbalance, etc. with source voltages. The general function of UPQC mainly depends on the series and the APF shunt controller.

II. Literature Review

Khadkikar, V et al. [8] This record gives a complete outline of Unified Power Quality Conditioner (UPQC) to further develop power quality at the conveyance level. This is planned to give an expansive outline of the various conceivable UPQC framework arrangements for single-stage (two-wire) and three-stage (three-wire and four-wire) organizations, different remuneration approaches and current improvements around here.

Priyavarthini S. et al. [9] This work proposes another method for utilizing the DVR to make up for the responsive force interest of the decent speed wind turbine, just as moderating the mains voltage plunges/floods. The voltage provided by the DVR is changed in accordance with keep a consistent voltage across the generator, while the period of the voltage across the generator slacks the line voltage by a steady point. A total examination for the "stage point" control is introduced and as far as possible for synchronous stockpile of receptive force and list/expand decrease are introduced in a graphical investigation.

Kesler et al. [10] This paper presents another simultaneous reference outline (SRF) based control strategy to make up for power quality (PQ) issues utilizing a four-wire three-stage PQ conditioner (UPQC) in high voltage applications unequal burden conditions and twisted. The proposed UPQC framework can further develop power quality at the normal coupling point in power dissemination frameworks under lopsided and twisted burden conditions.

Trinh et al. [11] This record presents an affordable, elite three-stage Unified Power Quality (UPQC) forced air system that utilizes three-stage inverters with four breakers. In the proposed UPQC, series dynamic force (APF) shunts and channels are created utilizing three-stage inverters with four switches, decreasing the quantity of changing gadgets in the proposed geography from twelve in the customary eight-gadget UPQC. Moreover, by putting an extra capacitor in series with the APF shunt, it is likewise conceivable to essentially decrease the halfway circuit voltage in the proposed UPQC.

III. OBJECTIVE

The main objective in this thesis are the follow are:

- Design of an inverter controlled by the SPVWM, which must guarantee an efficient power supply of users of different types. Inverter control must be designed to improve system performance. To do this, a spatial vector pulse width modulation technique has been developed which is then used to deliver pulses to the three-branch inverter.
- Design a power quality improvement system with a simplified architecture to support reactive power and improve the actual power available for load links.
- When designing the above controller, make sure that the output voltage at the terminals and the voltage available at a load terminal do not decrease.
- To improve system efficiency by using the controller and adapting it to different types of loads, all are reliable functional loads.

IV. METHODOLOGY

MALAB/SIMULINK system are the develop model.

The model was developed in MALAB / SIMULINK environment. This is the continuation of its main functions:

• Scientific and technical computer science in high-level language

- Desktop environment designed for iterative exploration, system design, and troubleshooting
- Charts to visualize data and tools to create custom charts
- Applications for curve fitting, signal analysis, data classification, control system tuning and many other tasks
- Complementary toolkit for a variety of technical and scientific applications
- Tools for creating applications with custom user interfaces
- Royalty-free implementation options to share MATLAB programs with end users

A dual voltage inverter system is modeled and can provide solar or wind resources to the load depending on availability, making the system more reliable.

The modeling of the different parts of the system was discussed in more detail. We mentioned the photovoltaic plant modeled with MPPT technology for its optimal operation, PMSG (Permanent Magnet Synchronous Generator) in relation to the wind turbine.

The VSI is designed to drive mixed loads. The system was a DC VSI storage capacitor model.

These are networked to the PCC and provide a non-linear and asymmetrical load. The VSI supplies the current available to the DER of the network. The DC source can be either the or an AC source via the rectifier coupled in the intermediate circuit.

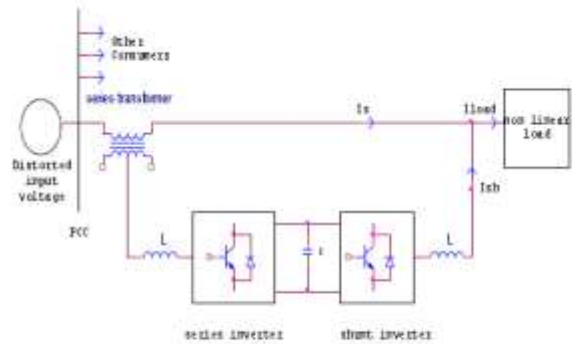

Fig. 1 proposed PQ compensation with load circuit diagram

1) Vector Modulation

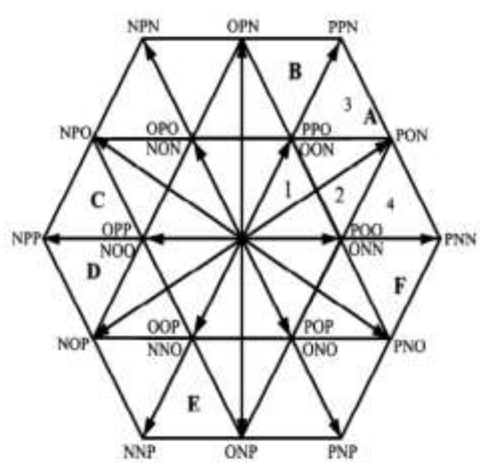

Fig. 2 Space-vector diagram of the three-level converter

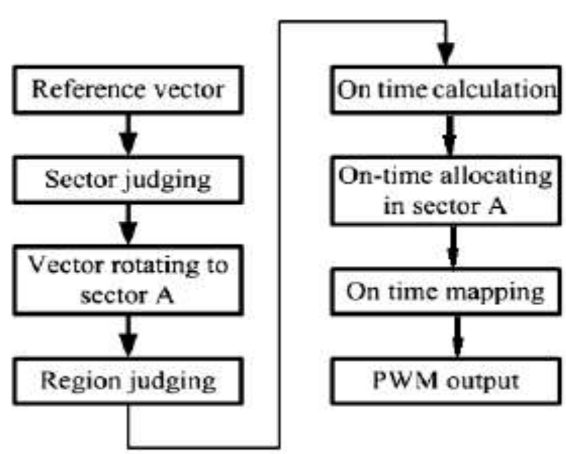

Fig. 3 SVPWM Simplified for the three level calculation flow

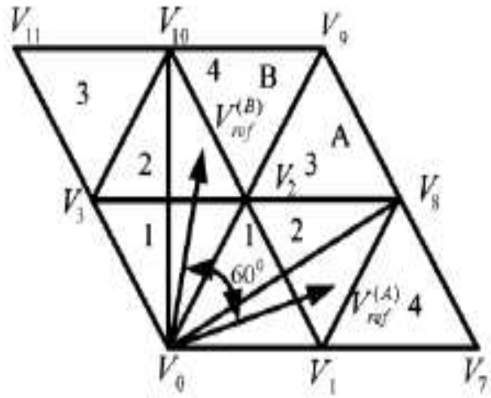

Fig. 4. Sector A and sector B 60^0 shifting

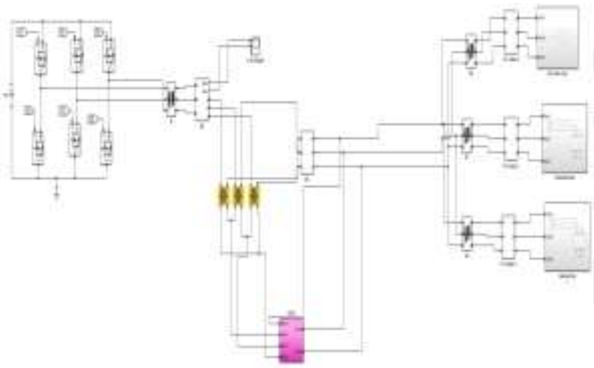

Fig. 5 Use UPQC in three level system simulation

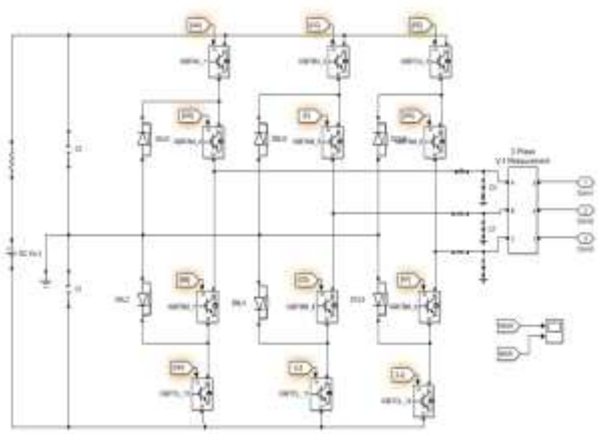

Fig. 6 PQ enhance in MATLAB architecture

V. Results

The controller used was developed with 12 IGBTs with specially developed pulses that are turned on each of them for the their operations. We get the following results, which are combined in both cases:

Study 1: System without enhancement of Power quality.

Study 2: System with enhancement Power quality in device.

Study 3: two systems in load analysis.

In the better solution the in this method for linear and the nonlinear load of the system. In the relationship of the amplitudes in the active power and the reactive power oscillation, which result from asymmetrical ratios of the line voltages, has been obtained.

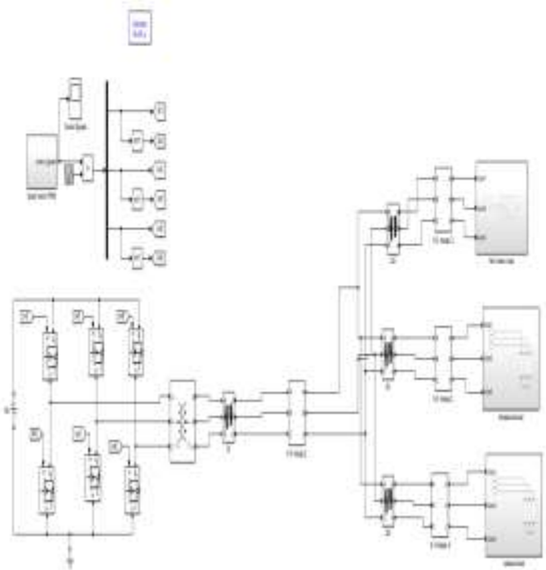

Fig. 7 system driving loads MATLAB/SIMULINK model in study 1

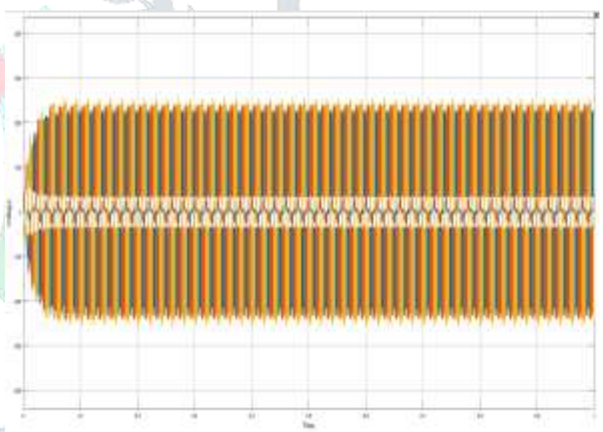

Fig. 8 system output Voltage from system in study 1

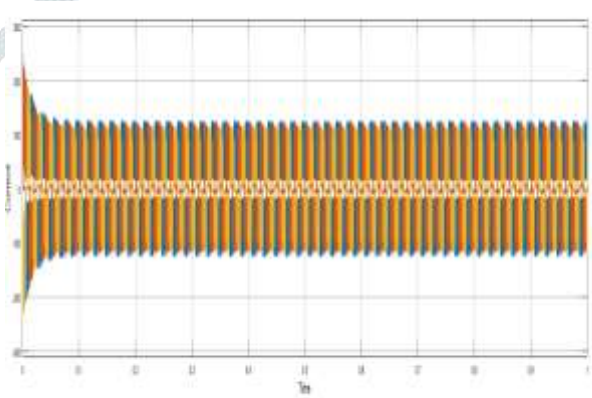

Fig. 9 system output current in study 1

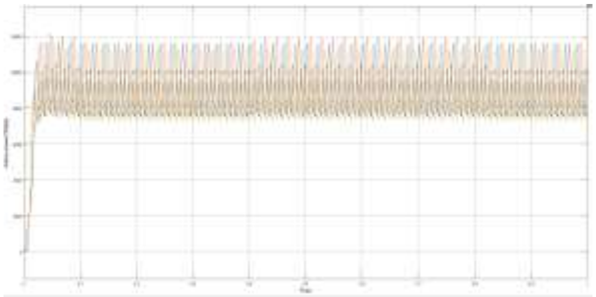

Fig. 10 system Active power output from system in study 1

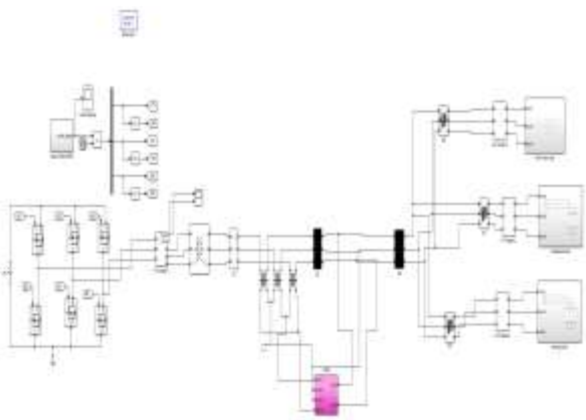

Fig. 11 system driving loads MATLAB/SIMULINK model in study 2

Fig. 12 system output voltage output from system in study 2

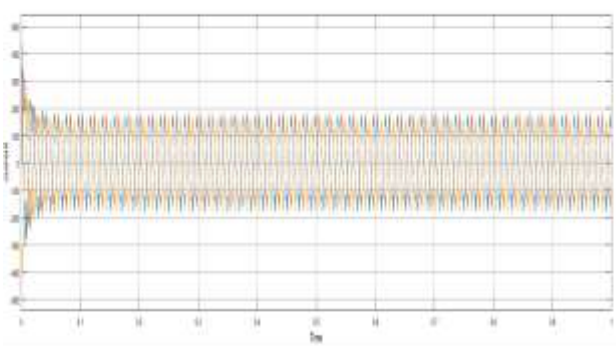

Fig. 13 system output current from system in study 2

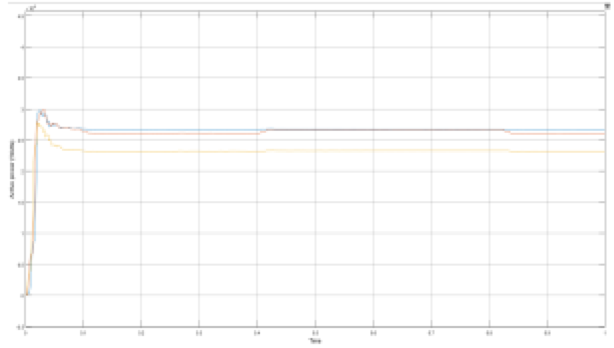

Fig. 14 System Active Power output from system in study 2

1) Two systems in load analysis

a) System load with Nonlinear

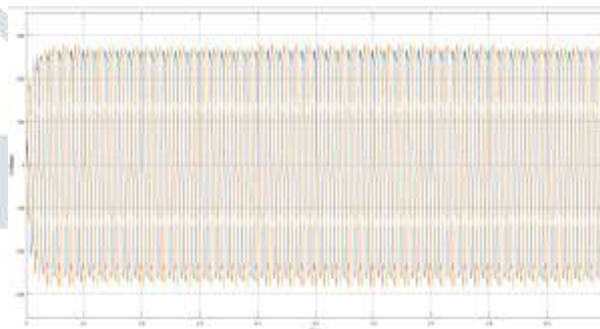

Fig. 15 system output voltage output with enhancement power

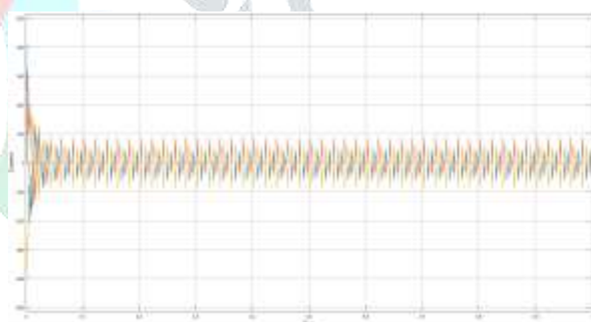

Fig. 16 system output current with enhancement power

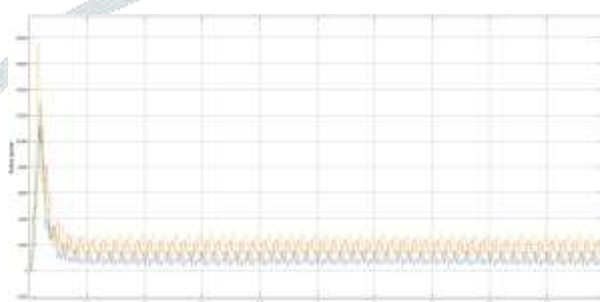

Fig. 17 system active power output with enhancement power

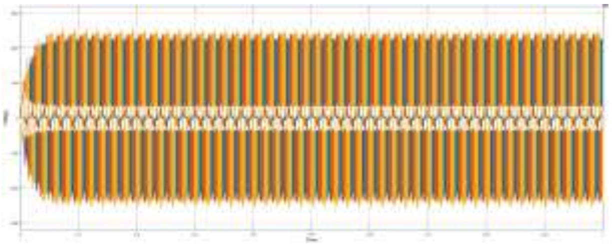

Fig. 18 system output voltage without enhancement power

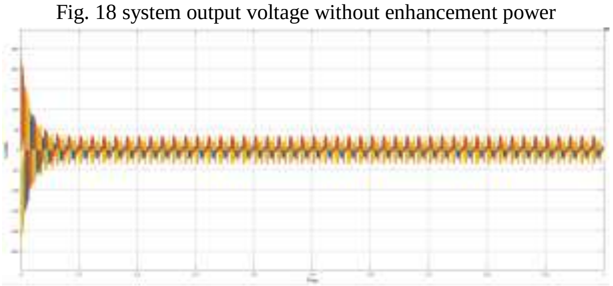

Fig. 19 system current output without enhancement power

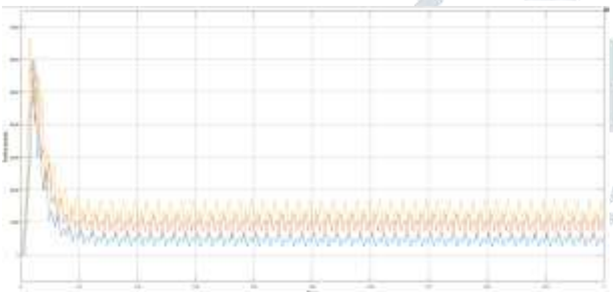

Fig. 20 system active power output without enhancement power

b) With Unbalanced load

Fig. 21 system output voltage output without enhancement power

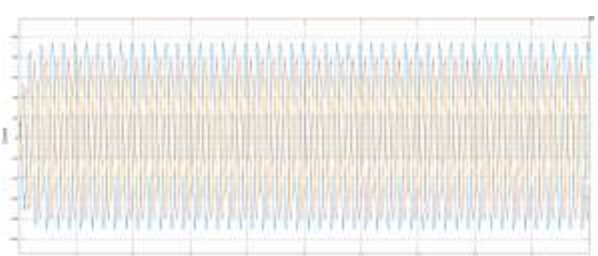

Fig. 22 system output current without enhancement power

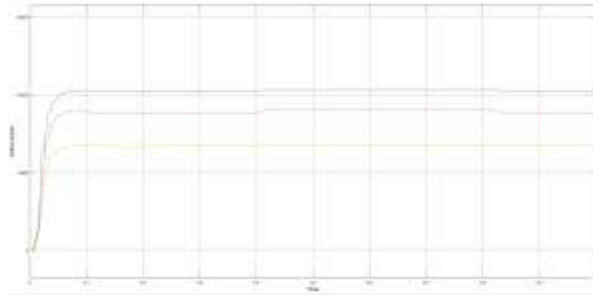

Fig. 23 system active power output without enhancement power

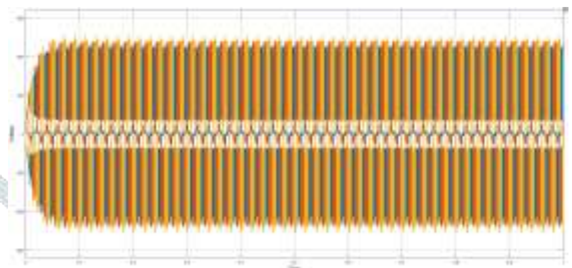

Fig. 24 system output voltage without enhancement power

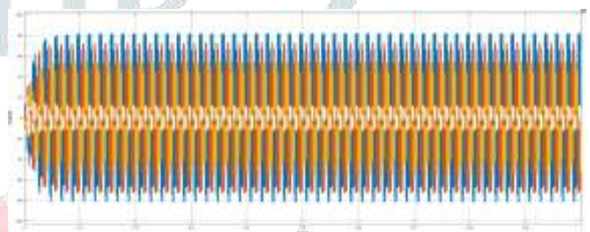

Fig. 25 system output current without enhancement power

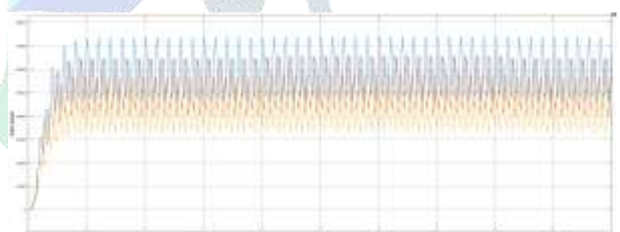

Fig. 26 system active power output without enhancement power

c) With Balanced load

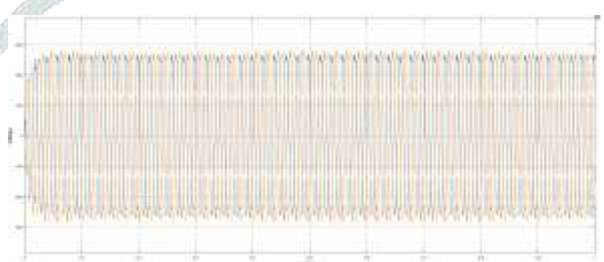

Fig. 27 system output voltage with enhancement power

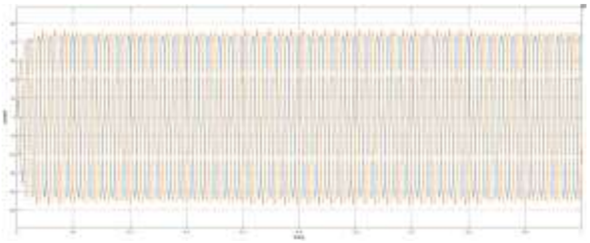

Fig. 28 system output current with enhancement power

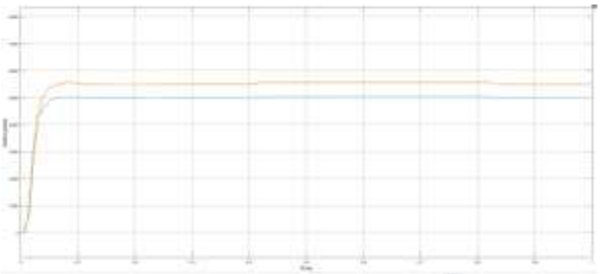

Fig. 29 System active power output with enhancement power

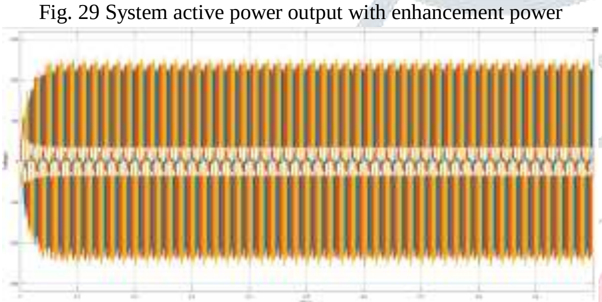

Fig. 30 system output voltage without enhancement power

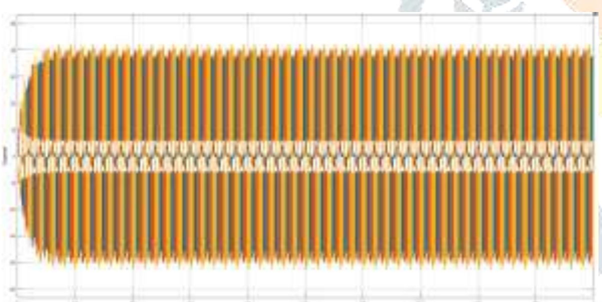

Fig. 31 system output current without enhancement power

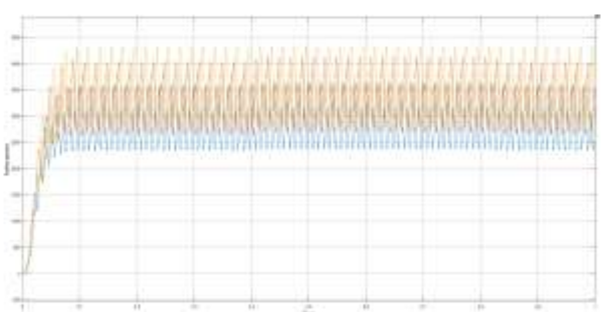

Fig. 32 system output active power with enhancement power

VI. VALIDATION

In this work, the performance was improved by using a device to improve the quality of the system performance. The systems are designed to drive different types of loads, non-linear, asymmetrical and symmetrical loads. The inverter works with SPWM modulation technology. This explains the improvement in the system's output power, which is then delivered to consumers. The device for improving the quality of the network is made with a diode and an IGBBT bridge circuit.

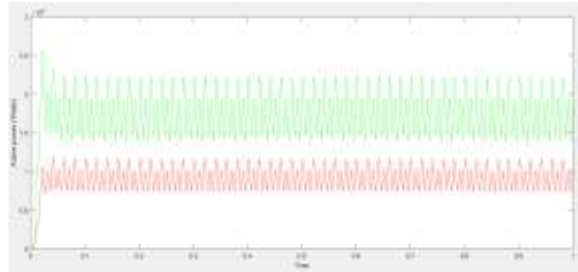

Fig. 33 system power Outputs of system to be the fed load

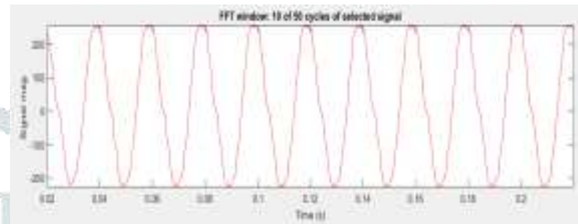

Fig. 34 system output in FFT analysis of system having enhancement of PQ

VII. CONCLUSION

In order to solve the influence of mixed non-linear and unbalanced loads on the output voltage of microsource inverters in the microgrid, this article suggests a comprehensive strategy that can be used for precise energy distribution, as well as a device for improving quality. of the power to the output power available to the load without changing the voltage level at the load connection.

Here in this thesis, we have designed SVPWM technology controlled inverter with network quality improvement system and modified MATLAB / SIMULINK with architecture and used it on different inverter loads.

In addition, two models were created that offered an inverter system model to drive mixed loads and the possibility of improving the quality of the network. The following main conclusions were drawn from the results.

- Comparing the active power output of the system without UPQC controller with the proposed device to improve the quality of the network with modified architecture, it was found that the proposed system provides 29 KW of power, which is considerably higher than 27.5 KW. the system without the device. The percentage increase is approximately 5%.
- The output power of the charging port system has also been improved to make the system more reliable.
- The level of the output voltage is kept constant during the activation of the loads.
- UPQC has compensated for mains voltage quality problems such as dips / shocks, asymmetry, flicker, harmonics, etc.

Therefore, it can be inferred from this work that when designing an inverter with a control strategy of SVPWM, the proposed improvement in device performance quality with better performance and better result efficiency can serve the purpose. This architecture can also be used in hybrid systems, which makes it more reliable. The designed system is also suitable for various types of load such as non-linear load, symmetrical load and asymmetrical load.

VIII. Future Scope

The installation of the inverter of a hybrid system on the solar grid will indeed be very successful as it will reduce the dependence on the grid system. In other words, it is necessary to promote the green energy system, in which the important source of energy runs out in daily life. Therefore, people have to look for new renewable sources and solar energy is certainly one of the best options for this purpose. In future work, adaptive control based on a neural network should be designed for better network quality three-phase networks with integrated linear and non-linear loads. The supplied control scheme regulates the grid voltage and improves the grid quality very effectively.

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