PERFORMANCE IMPROVEMENT OF GRID CONNECTED PV SYSTEM USING PSO

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***Abstract*: Fossil fuels and Water are the primary sources for generating electricity with large turbines coupled with synchronous generators in the customary power system. The new advent of lesser weight generators, hybridization of variable renewable sources, the electronic converter, digitalization in terms of monitoring and control encourages the modernization of power system which helps in decentralizing the dependency of large scale generation to many distributed generations which are located nearer to the Customer and also integrated with the electricity grid.**

In general, the optimal reactive power compensation could drastically enhance the performance of distributed network by the reduction of power loss and by enhancement of line load ability and voltage profile. Till now, there exist various reactive power compensation models including capacitor placement, joined process of on-load tap changer and capacitor banks and integration of DG. Further, one of the current method is the allocation of distribution FACTS (DFACTS) device. Even though, the DFACTS devices are usually used in the enhancement of power quality, they could be used in the optimal reactive power compensation with more effectiveness.
The proposed model is used for reduction of total harmonic distortion. The total harmonic distortion for system without UPQC, with UPQC and with PSO is 10.83 %, 4.15 % and 3.69 % respectively. In the proposed model, the proportional & integral constant is improved from 4.5 to 4.582 and 3.8 to 3.89 respectively.

***Keywords*: PV Solar, Fact Device, THD, PID Controller**

I. INTRODUCTION

Recent growth in the area of supply and demand technologies, energy storage devices, and electricity transmission mode enhances the transformation of the power system from a conventional integrated model to the modernized hybrid distributed /integrated power system model. The traditional power system model depends more on the centralized large scale generation transmitting electricity to the remote customer having passive loads via High voltage transmission line. Fossil fuels and Water are the primary sources for generating electricity with large turbines coupled with synchronous generators in the customary power system. The new advent of lesser weight generators, hybridization of variable renewable sources, the electronic converter, digitalization in terms of monitoring and control encourages the modernization of power system which helps in decentralizing the dependency of large scale generation to many distributed generations which are located nearer to the Customer and also integrated with the electricity grid.
Though there are a lot of advantages in terms of the modern power system, compared to the traditional centralized power system, there are some of the issues to focus which have been mentioned below:
1. Unreliable generation characteristics of renewable energy resources like solar & wind incorporation have increased the complication in terms of transmission and distribution planning.
2. Increased use of smart power electronic control based types of machinery from the pure electro-mechanical control in the industries and commercial application adversely affect the load demand in the grid.
3. Recent trends in the utilization level of the energy-efficient electric vehicles, heat pumps, and industrial appliances impact the transmission and distribution planning due to the inelastic variation of load profiles, which upraises the peak loads.
4. Digitalization enhances the usage of electronic items in the home, commercial, and industrial areas, which in turn affects the optimization of the supply-demand balance.
5. Increased participants in the attractive modern power system create high competition in attaining the maximum profit, which in turn increases the stress in transmission and distribution of the power system which adversely affects the security and reliability of the power system
To faces these encounters, smart solutions needed to apply in concurrence with the modernization of network restructuring with the replacement of advanced energy-efficient and highly reliable components. Also, efficient load forecasting methodologies need to be practiced in accommodating the uncertainties concerning the dynamic load variation. The development planning results of all individual stages need to be coordinated to provide safe, reliable, and resilient electricity delivery.

II. FACT DEVICES

Transmission and other asset inadequacies have pushed power system engineers to develop a power electronics-based approach in place of standard compensatory strategies. In order to deal with the rising demand and supply of electricity, the Flexible A.C. Transmission System (FACTS) technology was created. The primary goals of FACTS technology are to improve the transmission networks' capacity to transmit power and to maintain power flow along predetermined paths. The transmission lines can be operated at their thermal limitations with the aid of FACTS technology, resulting in increased power transfer. This does not imply that the lines would be run at their thermal limit loading (the transmission losses would be unbearable) on a regular basis, but this option would be accessible if necessary to tackle severe system crises. Instead of utilizing substantial steady state margins, the standard power transfer over transmission lines is predicted to grow dramatically by using FACTS controllers to provide the necessary rotational and voltage stability. As a result of combining two distinct methodologies, the new FACTS controller generation is uniquely equipped to deal with specific transmission issues. Control elements in the first set of controllers include reactive impedances or an adjustable tap changing transformer with thyristor switches; the second set employs self-commutated converters. Customers and utilities alike benefit from the power quality improvements offered by FACTS (Flexible AC Transmission System). There are three types of FACT devices.

1. Thyristor Controlled Series Compensator (TCSC)
2. Static Compensator (STATCOM)
3. Unified Power Flow Controller (UPFC)

III. Proposed Work

From the literature survey and after study of PV module and MPPT technique, it clear that power output is not maximum as per required. So, MPPT techniques with AI is used. Figure 4.1 depicts the UPQC distribution network as a whole. Combining the functions of both series and shunt compensators, the UPQC is a unique device. For nonlinear and unbalanced loads, the supply voltage is sinusoidal. Can also check sure the supply current is (is) in synchronization with terminal voltage (vt). As a result, a nonlinear and unbalanced load will have no effect on the voltage of any buses upstream of the PCC. In any case, this device will not be able to fix the imbalance and distortion caused by the source voltage. Because of this, the voltages on the upstream bus will stay skewed and imbalanced. As one controller interferes with the other's capacity to track the voltages across their respective capacitors, the stability issue will occur. As a result, the series inverter's LC filter construction is better suited to the right shunt UPQC in order to prevent the tracking issue. As an additional benefit of using an LC filter, main transformer harmonics can be limited.

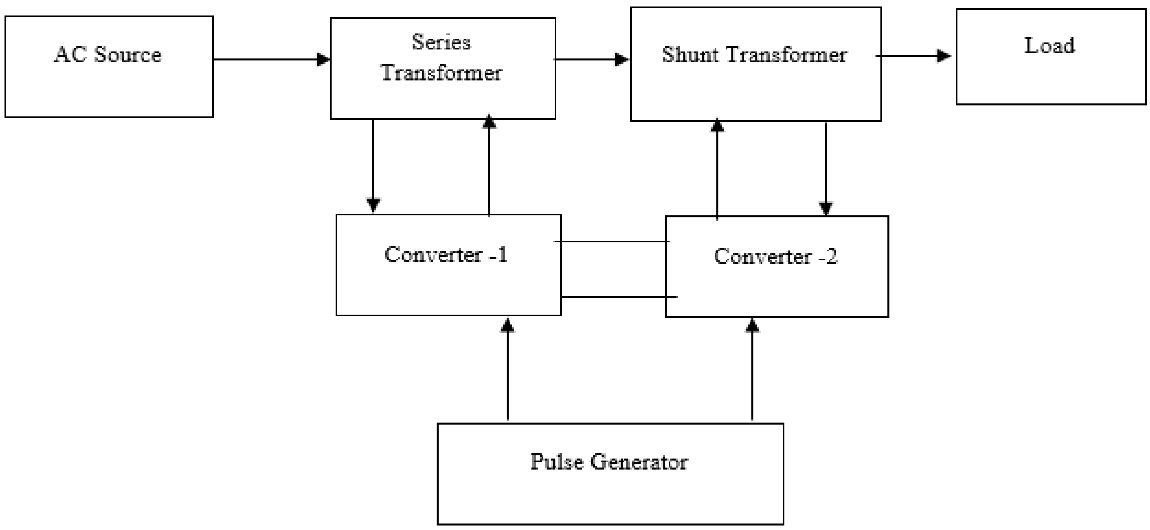

Figure 1 Generalized UPQC Controller

Multiple power quality concerns may be addressed with UPQC. There are usually two VSCs linked to a common DC connection at the heart of the UPQC. A self-sustaining DC bus voltage is maintained between the two VSCs through the DC connection. Figure 1 shows the schematic diagram of the right-shunt UPQC. The series inverter is linked to the three-phase AC system by a series injection transformer, while the shunt inverter is connected to the loads or the PCC in parallel. The real power requirement for the series inverter is supplied from the main grid through the shunt inverter.
The gating signals required for the VSC are generated using appropriate control algorithms. The series inverter with PWM voltage control inject the voltage in series with AC source and the shunt inverter using hysteresis current control injects the compensating current parallel to the load through a coupling inductor which smoothens the current waveform.

IV. RESULT ANALYSIS

The different current, voltage and power is analyzed in this section. Load Voltage and Load Current is shown in fig 2.

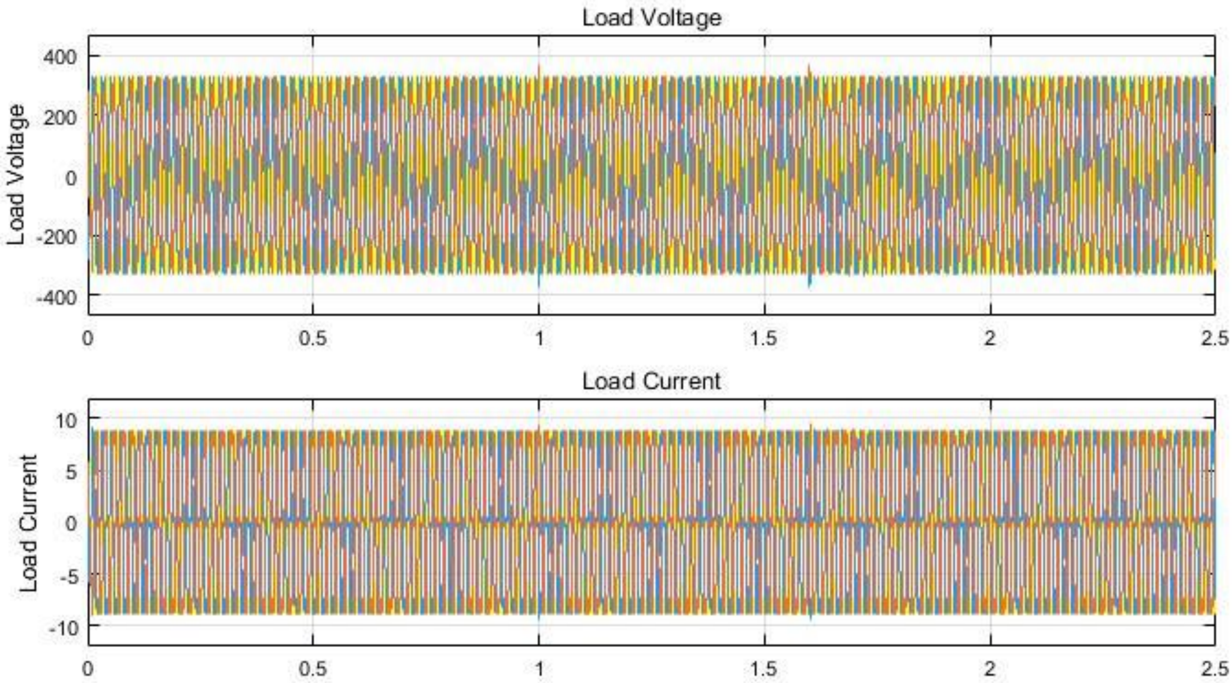

Fig 2 Load Voltage and Load Current

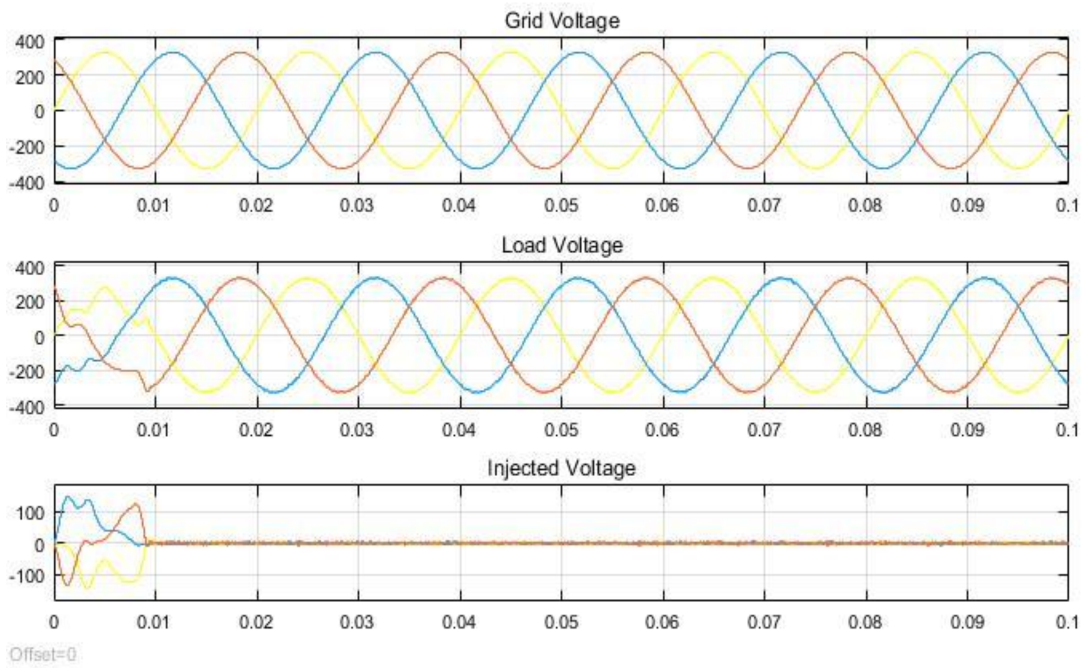

Fig 3 Grid Voltage, Load Voltage and Injected Current

Grid Voltage, Load Voltage and Injected Current is shown in fig 3 and Supply & Load Voltage, Injected Voltage and DC Voltage is shown in fig 4.

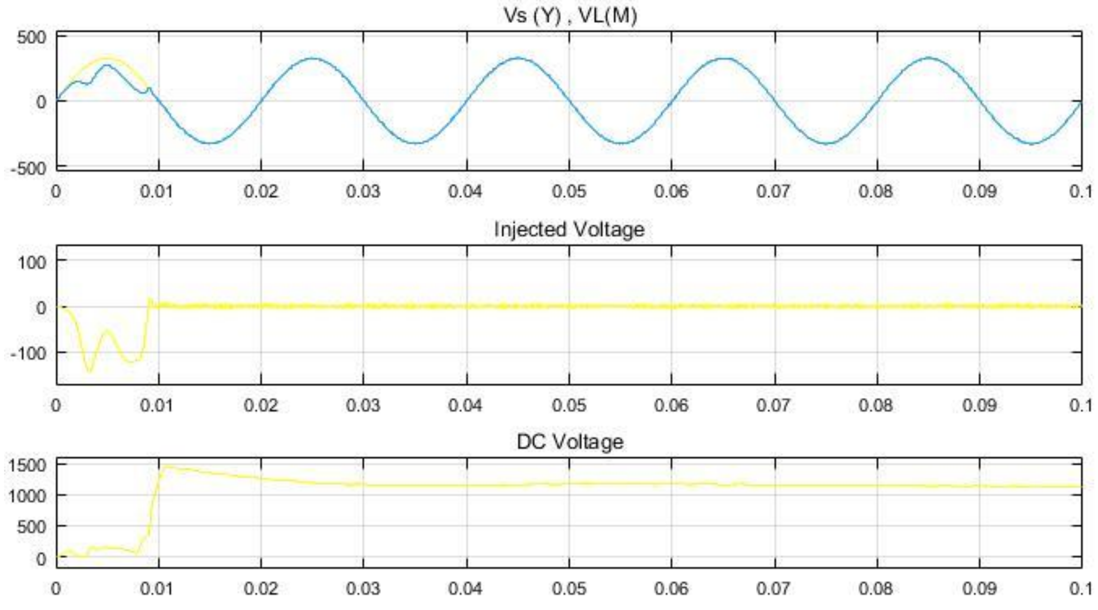

Fig 4 Supply & Load Voltage, Injected Voltage and DC Voltage

V. CONCLUSION

The objective of this work is to develop an improved control algorithm for UPQC to compensate for both current and voltage related quality issues in a power network under all types of possible system conditions such as balanced source/ balanced linear or non-linear loads, balanced source/unbalanced nonlinear loads, distorted source/balanced linear/non- linear loads, distorted source/ unbalanced linear/non-linear loads and voltage sag/swell balanced/unbalanced linear/non-linear loads. The scholar proposed Genetic Algorithm by which voltage and current qualities can be improved. The simulation is followed by testing in lab system developed for this purpose. The effectiveness of the algorithm is compared with other widely used algorithms such as synchronous reference theory, synchronous detection and Algorithm. The results illustrate that GA has better performance in terms of reduction in reactive power, THD, and power factor improvement.

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