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A Control Technique for Integration of DG units with PVMPPT to the Electrical Networks

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ABSTRACT: This paper deals with a multiobjective control technique for integration of distributed generation (DG) with photovoltaic array maximum power point tracking (PVMPPT) resources to the electrical power network.The proposed stragegy provides compensation for active,reactive,and harmonic load current components during connection of DG link and PVMPPT link to the grid. By setting an appropriate compensation current references from the sensed load currents in control circuit loop of DG, the active, reactive,and harmonic load current components will be compensated with fast dynamic response, thereby achieving sinusoidal grid currents in phase with load voltages, while required power of the load is more than the maximum injected power of the DG to the grid. In addition, the proposed control method of this paper does not need a phase-locked loop in control circuit and has fast dynamic response in providing active and reactive power components of the grid-connected loads. The effectiveness of the proposed control technique in DG application is demonstrated with injection of maximum available power from the DG and PVMPPT to the grid, increased power factor of the utility grid, and reduced total harmonic distortion of grid current through simulation and experimental results under steady-state and dynamic operating conditions. When we connect the DG with PVMPPT then reduced more THD when increased non linear load and supplies more continues power to the grid by PVMPPT and reduced cost of capacitor.

KEYWORDS: DG Link, PVMPPT Link,Grid System, Non Linear Load,MATLAB/Simulink

I. INTERODUCTION

The increase in industrialization leads to energy demand. Most of the energy demand is supplied by the fossil fuels. However, increase in air pollution, diminishing fossil fuels and their increasing cost have made it necessary to gaze towards renewable energy sources as a future energy solution. Among these Renewable Energy Sources (RES), solar power systems and wind power systems are the affable solution for electrification. As the solar energy is available in nature and due to its inexhaustible availability, they become most promising renewable energy sources. Hence, Photo Voltaic (PV) system has been increasingly used in medium sized grid and the wind mill is widely used all around the world. The penetration of power electronic converters used for integration of RES at distribution level may create a hazard to network in terms of power quality problems such as harmonics. This harmonics may lead to malfunctioning of protective relays and other control unit. Hence the harmonics has to be reduced. The implementation of active filter results in an additional hardware cost. In order to overcome these problems, solutions are proposed in this research work. The most effective solution for harmonic compensation is the active filter. This chapter discusses about the background of the solar energy, wind energy and power quality improvement in grid connected Renewable Energy Source

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II. SIMULATION ANALYSIS

In order to demonstrate the high performance of the proposed control technique, the complete system of model was simulated using the "Power System Block set" simulator operating under the Matlab/Simulink environment. The schematic diagram and principle of the proposed model and the control technique in an ac grid are shown in Fig.1. The test model contains a power converter with power rating of 20 kVA. The maximum available value of DG source active power is 8 kW, which is also an active power reference included in the simulations.

At first, capabilities of DG resources and flexibility of proposed control strategy to control the proposed VSC in providing active, reactive, and harmonic current components of different loads are shown, and the capabilities of proposed control method on reactive power tracking with constant output active power are considered. In addition, the simulated results have been used to analyze the total harmonic distortion (THD) of the utility grid current amid severe varying load conditions. During the simulation process, constant dc voltage sources have been considered as a DG source. In addition, active power which is delivered from the DG link to the ac grid is considered to be constant.

This assumption makes it possible to evaluate the capability of the proposed control strategy to track the fast change in the active and reactive power, independent of each other. For this purpose, when one of them is changed, another one must be constant. To simulate the real ac grid, the load is connected and disconnected to the power grid randomly, and grid current waveform will be compared with each other under various loads and conditions.

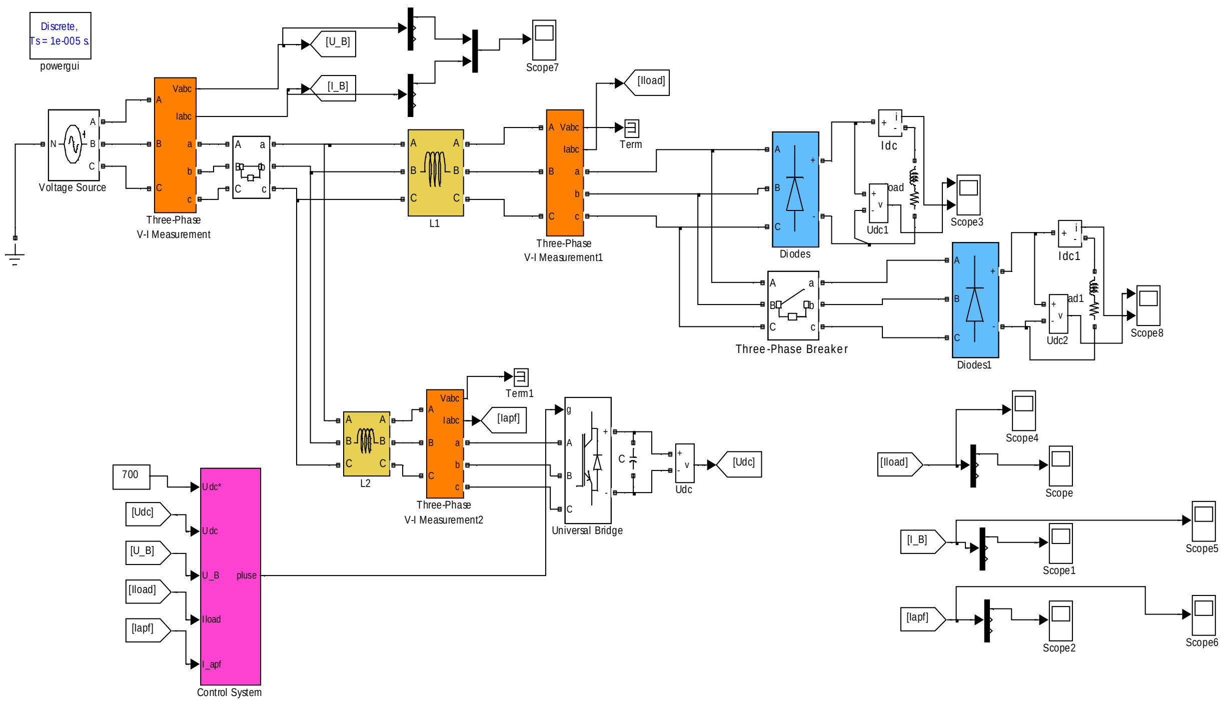

Fig 1 schematic diagram of proposed DG system by using MATLAB/Simulation

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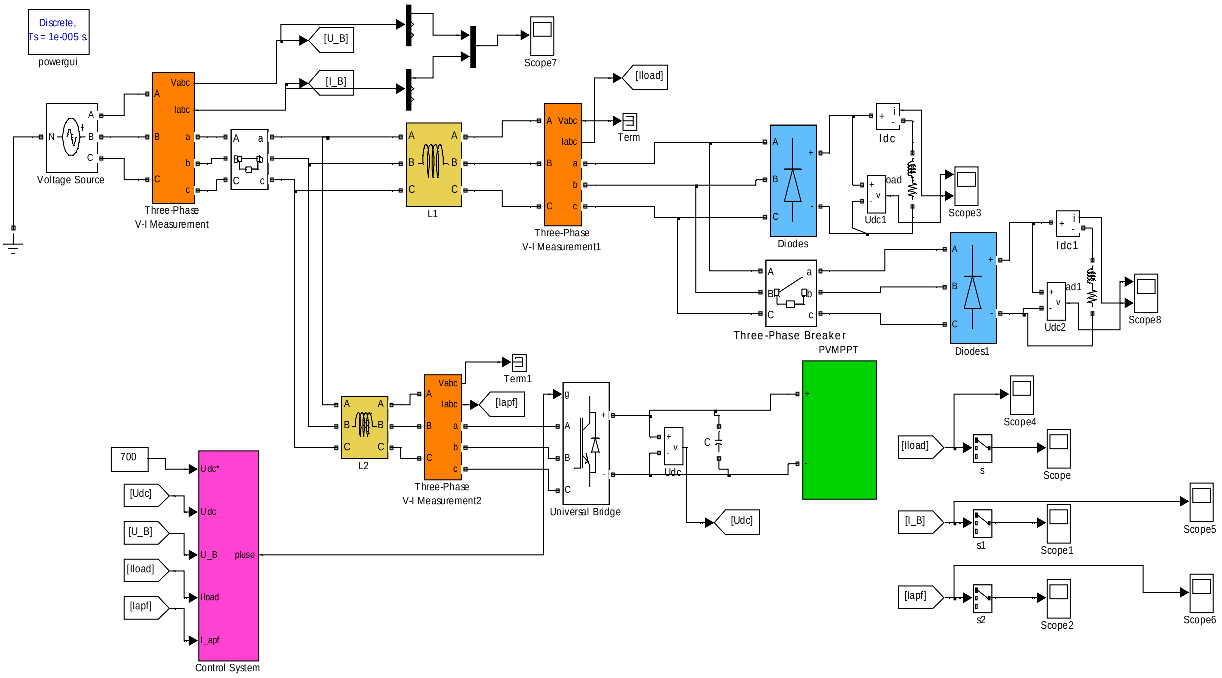

Fig. 2 schematic diagram of a proposed DG System with PV MMPT by using MATLAB/Simulation

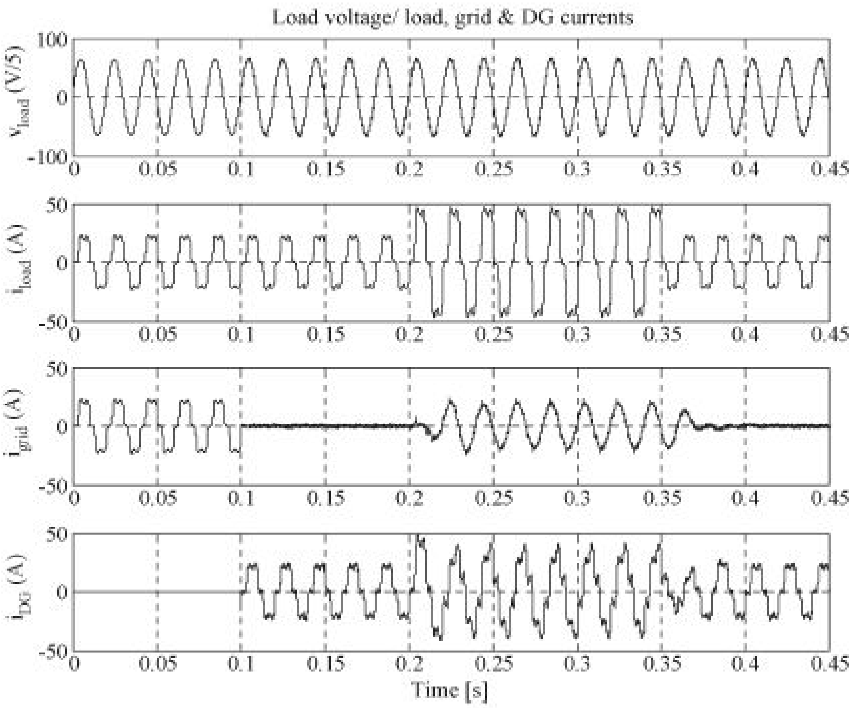

Fig. 3Load voltage, load, grid & DG currents before and after connection of DG and before and after connection and disconnection of additional load into the grid.

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III. RESULT AND DUISCUSSION

THD Analysis

Table 1.1Fundamentals and THD Values of Grid Currents

Before Compensation				After Compensation		
Peak Current (A)	I_{grid1}	I_{grid2}	I_{grid3}	I_{grid1}	I_{grid2}	I_{grid3}
Fundamental	47.16	47.23	47.64	17.67	17.73	17.54
THD%	21.39	21.29	21.84	4.26	4.28	4.35

THD of the grid currents while feeding nonlinear loads. The THDs of the grid currents are reduced from 21.39%, 21.29%, and 21.84% before compensation to 4.26%, 4.28%, and 4.35% after compensation, respectively. These results confirm the capability of the proposed DG link to compensate harmonic currents of the nonlinear loads.

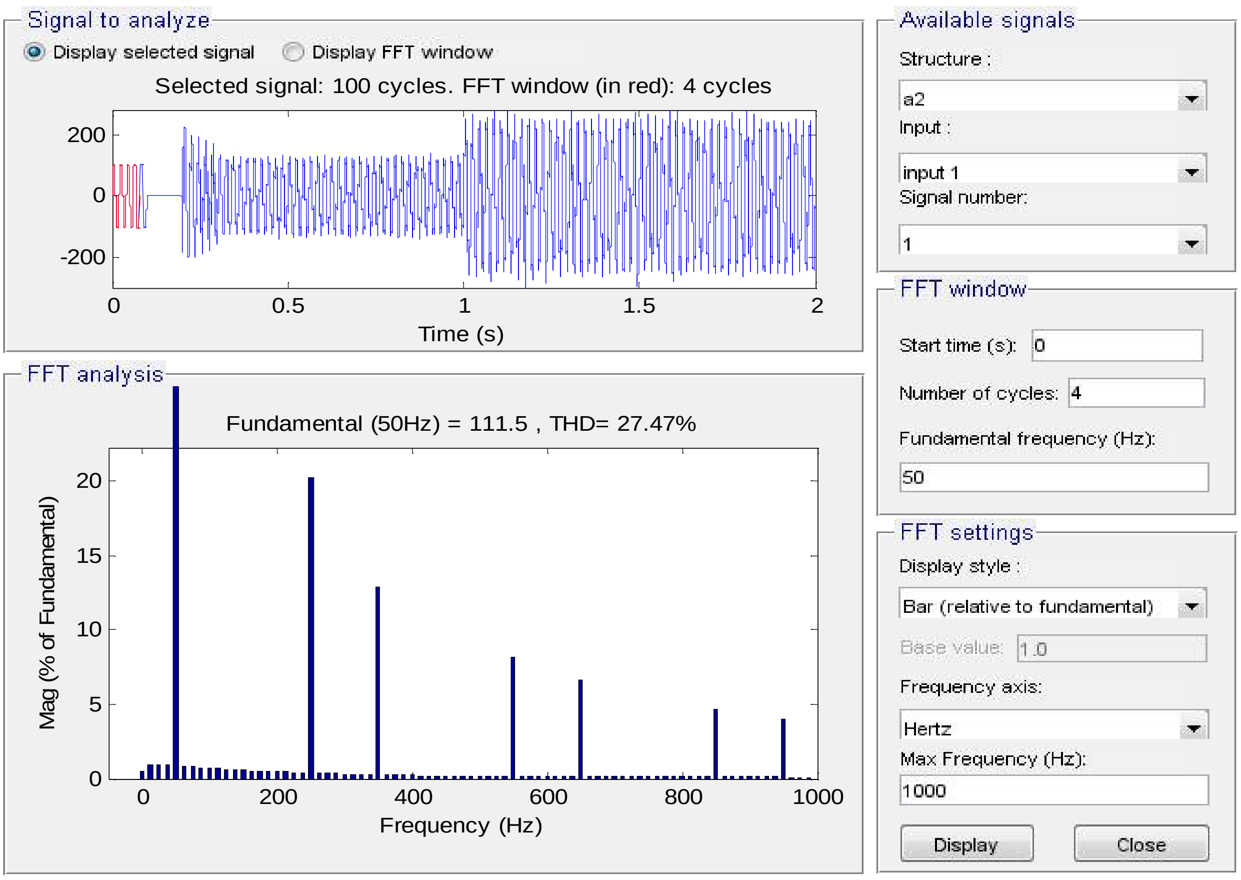

Fig. 4 THD analysis before connected the DG link

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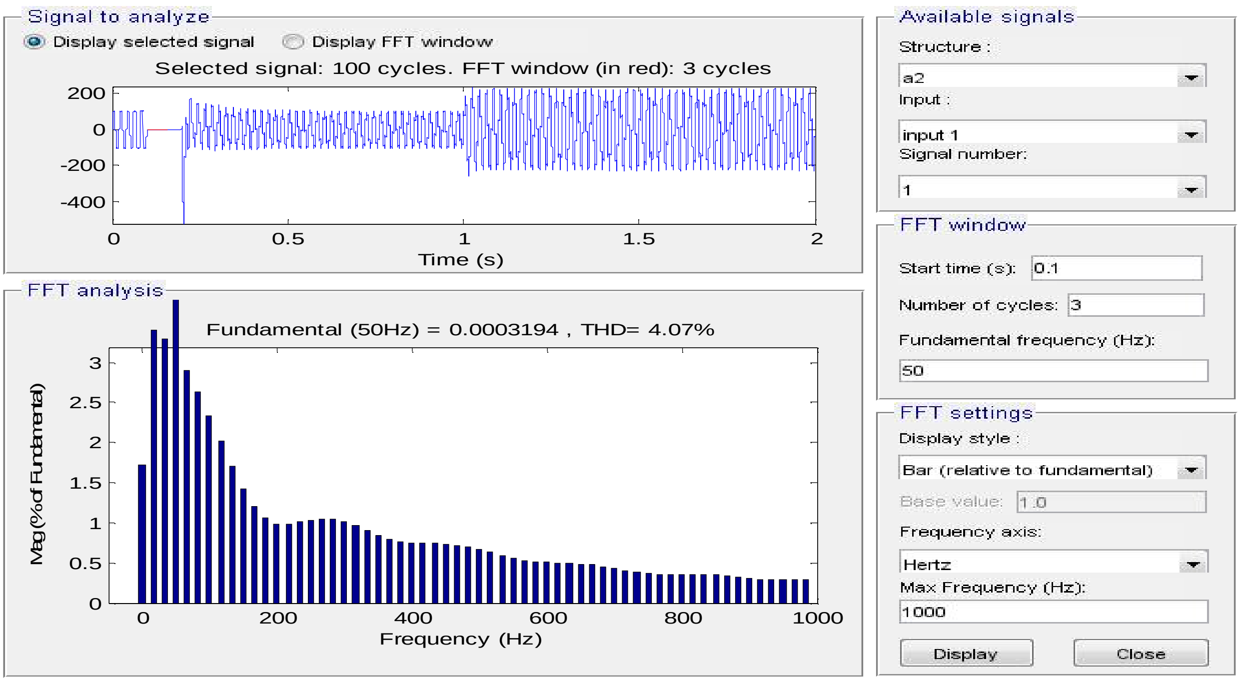

Fig. 5 a

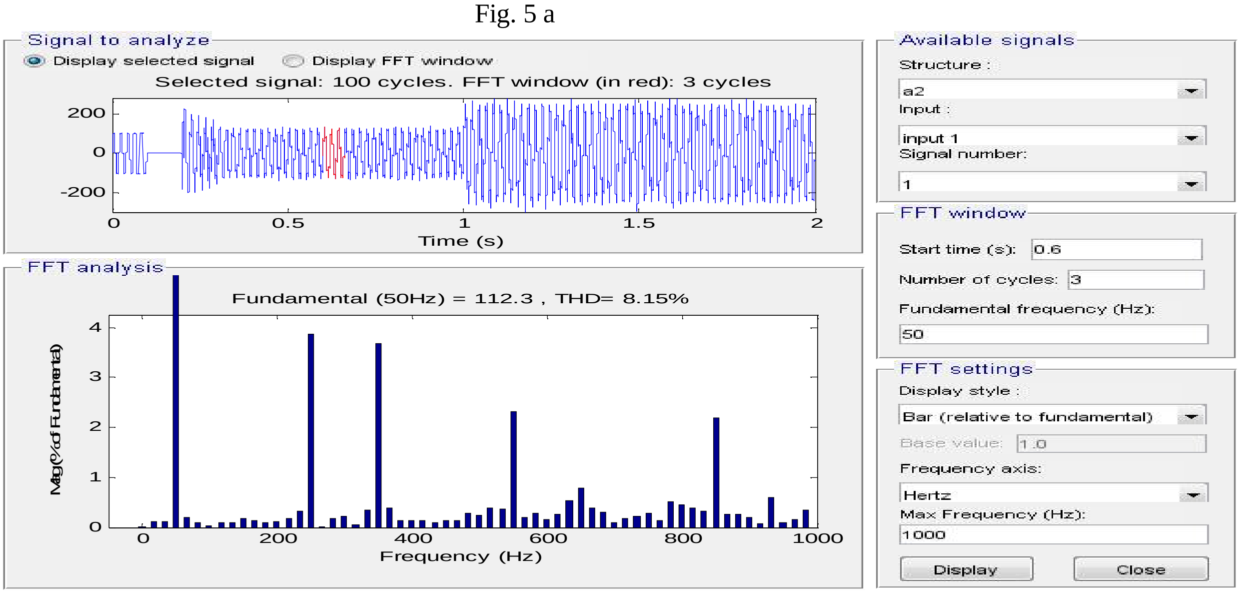

Fig. 5 b

Fig. 5 a) is THD analysis after connected the DG link and b) is after connected the additional load

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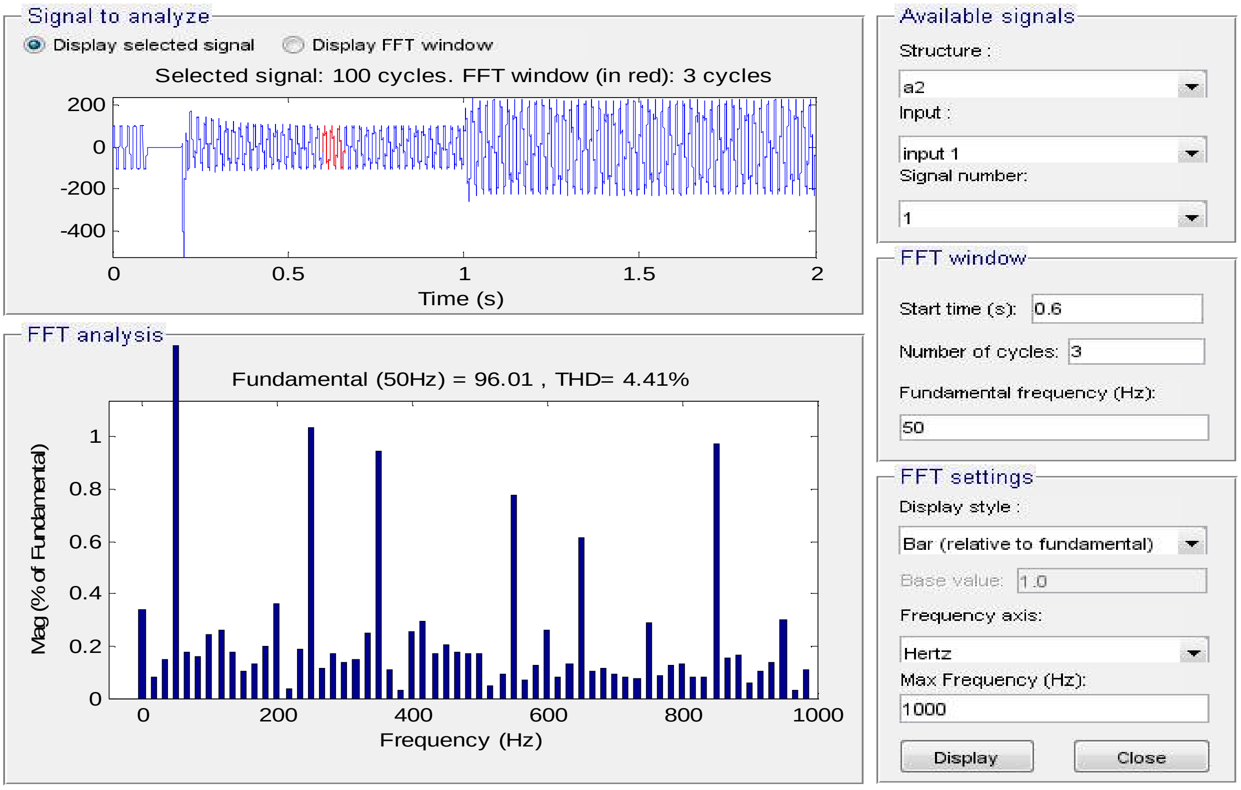

Fig. 6 THD analysis after connected the PVMPPT link

IV. CONCLUSION

A multi-objective control algorithm for the grid-connected converter-based DG interface has been proposed and presented in this paper. Flexibility of the proposed DG in both the steady-state and transient operations has been verified through the simulation results. Due to sensitivity of phase-locked loop to noises and distortion, its elimination can bring benefits for robust control against distortions in DG applications. Also, the problems due to synchronization between DG and grid do not exist, and DG link can be connected to the power grid without any current overshoot. One other advantage of proposed control method is its fast dynamic response in tracking reactive power variations; the control loops of active and reactive power are considered independent. By the use of proposed control method, DG system is introduced as a new alternative for distributed static compensator in the distribution network. The results illustrate that, all in conditions, the load voltage and the source current are in phase and so, by improvement of power factor at the PCC, DG systems can act as power factor corrector devices. The results indicate that proposed DG system can provide required harmonic load currents in all situations. Thus, by reducing THD of source current, it act as an active filter. The proposed control technique can be used for different types of DG resources as power quality improvement devices in a customer power distribution network.
We are improvement the power quality and power factor by reducing the total harmonic distortion (THD) by the using of proposed DG system with PVMPPT

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