RES NETWORKS: HIGHER PERFORMANCE ANN CONTROLLER USING CONSTANT CURRENT CONTROLLER

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ABSTRACT

This study details the grid integration of the photovoltaic solar power generator and its extensive design and modeling. The Photovoltaic System has a huge potential since it employs solar energy, one of the renewable resources, to produce electrical energy. In comparison to other renewable energy sources, the PV system is evolving far more quickly. The DC-DC Boost converter increases the DC voltage produced by the PV system. Via a 3-PWM DC-AC inverter with a constant current controller for control, the PV solar power generator is connected to the utility grid. This controller responds quickly enough to changes in load or grid by using a three-phase locked loop (PLL) to detect the utility grid's phase angle connection states, as a result, it seems to be efficient in supplying to load the constant voltage without phase jump. The complete mathematical model for the grid connected PV system is developed and simulated. The results verify that the proposed system is proficient to supply the local loads.

Keywords: BESS, Circuit breaker, switch off time period, ESS.

INTRODUCTION:

Decentralized renewable energy generation is necessary for the ongoing rise in electrical energy consumption while maintaining a clean environment. Growing energy use might overburden power plants and distribution networks, which would have a bad effect on the quality, security, and availability of power. The utility grid must be integrated with renewable energy sources like solar, wind, and hydro in order to solve this issue. Depending on the availability of renewable energy sources, the grid1 can be connected to the renewable energy system. As solar energy is more accessible, efficient, and environmentally benign than conventional power generating systems like those powered by fossil fuels, coal, or nuclear power, it has recently attracted greater attention. The PV systems are still very expensive because of higher manufacturing cost of the PV panels, but the energy that drives them -the light from the sunis free, available almost everywhere and will still bepresent for millions of years, even all non-renewable energy sources might be depleted. One of the major advantages of PV technology is that it has no moving parts. Therefore, the PV system is very robust, it has a long lifetime and low maintenance requirements. And, most importantly, it is one solution that offers environmentally friendly power generation.

The disadvantage of the PV system is that it can supply the load only in sunny days. Therefore, for improving the performance and supplying the power in all day, it is necessary to hybrid the PV system into another power generation systemsor to integrate with the utility grid. The integration of the PV system withthe utility grid requires the PWM voltage source converter for interfacing the utility grid and results some interface issues [1]. A prototype currentcontrolled power conditioning system has been developed and tested.This prototype sources 20 kW of power from a photovoltaic array witha maximum power point trackingcontrol. The disadvantage of this system is the need of high bandwidth current measurement transducers (dc to several times the switching frequency), and the need for relativelyhigh precision in the reference signal generation. Hence, this increases the cost of the system [2]. The inverters suitable for the PV system are central inverters, string inverters, Module integrated or module oriented inverters, multi string PV inverter with new trends has been described in [3]. If these solar inverters are connected with the grid, the control ofthese inverters can be provided using the phase locked loop [4]. The need and benefits of the distribution technology has been presented [5-6]. Single-phase Grid connected PV inverters with the control has been described with its advantages and disadvantages [7]. The three-phase Photovoltaic power conditioning system with line connection has been proposed with the disturbance of the line voltage which is detected using a fast sensing technique. The control of the system is provided through the microcontroller [8]. Power electronic systems can also be used for controlling the solar inverter for interfacing the Solar Power Generation system with the grid [9- 11]. The complete design and modeling of the grid connected PVsystem has been developed to supply the local loads.

OVER VIEW

This paper proposes the modeling of the grid connected PV system with theconstant current controller (CCC), which controls the solar inverter for interfacing the grid. The voltage level of DC voltage generated by the PV array is increased using the boost converter and then applied to the 3-_,2 level Solar inverter. The control of the solar inverter is provided through the constant current controller. This controller uses the Phase Locked Loop (PLL) and PI controllers. The PLL is used for tracking the phase angle of the grid voltage. The PI controller gains are chosen such that the CCC generates the pulses for solar inverter according to the grid voltage. The proposed model is able to supply the 2 MW resistive loads and 30 MW, 2 MVAr load the applicable criteria that follow.

RELATED STUDY

The concept of the SMES/battery hybrid energy storage is, therefore, proposed by combining two kinds of complementary energy storages. In this paper, a detailed scheme of the SMES/battery hybrid energy storageis presented, which has the advantages of both primary energy storage systems meanwhile complementing the disadvantages of each ESS. The control of the battery and the SMES isthe key factor to achieve the expected power distributions andcomplementary functions of the ESSs [2]. For the single energy storage technology used in the power system, the charge/discharge demands for the single ESS are straightforward. However, in the hybrid energy storagescheme, the control task is much morecomplicated because the control needsto effectively combine the harmonious operation of two storage technologies such that they complement each other. Fuzzy control, which can realize power management in nonlinear systems without accurate systemmodelling has been proven highly suitable for coordination of multiple energy sources. In propose a fuzzy control based method in railway power systems, achieving effective power sharing between the battery and the SMES. However, some specific constraints and fuzzy regions used in this control are selected empirically, which sometimes may lead to sub-optimal design choices. Wang et al. in [7] proposed the conceptual control method that classifies the power requirements manually and distributes the power demands to the different energy storage systems based on their classification. However, the accuracy of this controller is highly dependent on the specific implementation. The filter based power control method which uses the inherent filtration characteristic of the SMES or supercapacitor to allocate low-frequency charge cycling to the battery has been applied in EVs and renewable generations. In this control scheme, the SMES and the battery arein parallel position and deal with the power fluctuation at the same time.Consequently, the battery may still experience the high-frequency power fluctuations which result in stinging charge/discharge of the battery. A modified fraction control method is, therefore, developed to share the power between the SMES and the battery. In the new method, the SMESand the battery are in series position, and the power disturbances are firstly dealt by the SMES. The battery worksas the energy buffer to maintain the SMES current. Hence, the battery charges and discharges according to the SMES current rather than the instantaneous net power. The experiment shows that compared with the preceding fraction based HESS control, the new control scheme is able to protect the battery from abrupt power changes.

PROPOSED SYSTEM

The proposed block diagram shows the configuration of the grid integrated PV system. The PV array is the combination of series and parallel connected PV module. Each PV module has series connected PV cell according to the voltage requirements.The MPPT technique is applied foroperating the PV array at themaximum power point. The Vrefgenerated by the MPPT is the desired DC voltage of the PV array and compared with the actual voltage of the PV array. The error signal is processed by the PI controller for minimizing the error. That control signal is compared with the triangular waveform for obtaining the switching pulses for the switch SW1. This arrangement controls the duty ratio for varying the load according to the MPPT. The boost converter stepping up the voltage level of the PV array. The 2-level inverter is inverting the DC voltage 600 V into the sinusoidal AC signal 415 V. A constant current controller is providing the switching pulses to the inverter.

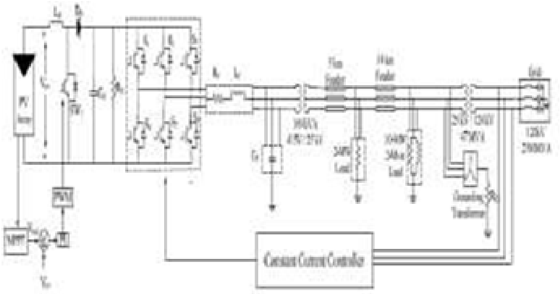

Fig.3.1. Proposed system.

SIMULATION RESULTS:

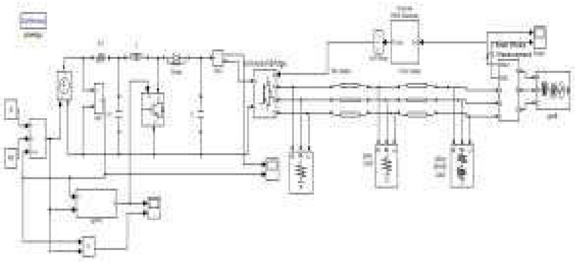

Fig.4.1.Simulation circuit.

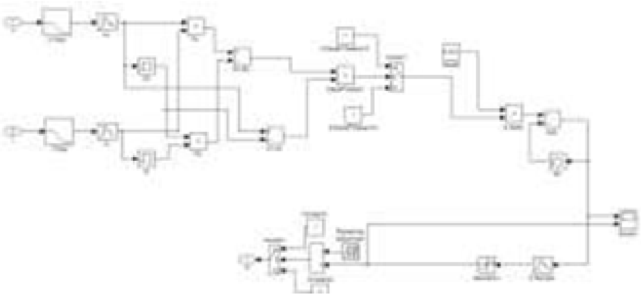

Fig.4.2. MPPT algorithm to generate thetriggering pulses.

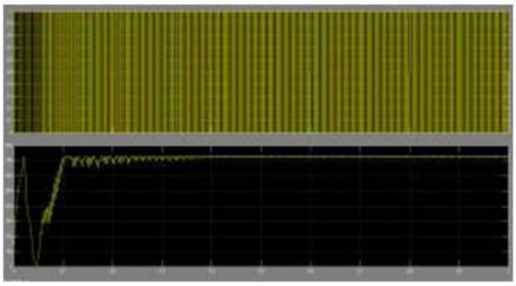

Fig.4.3. MPPT results.

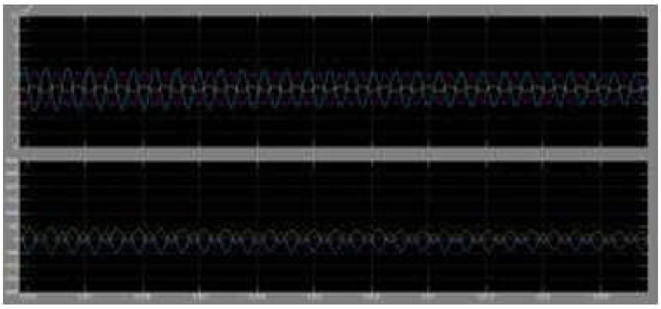

Fig.4.4. OUT PUT RESLUTS.

Extension with ANN controller:

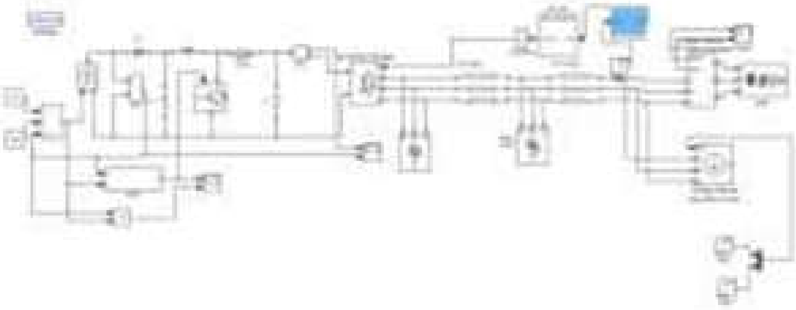

Fig.4.5. With ANN controller.

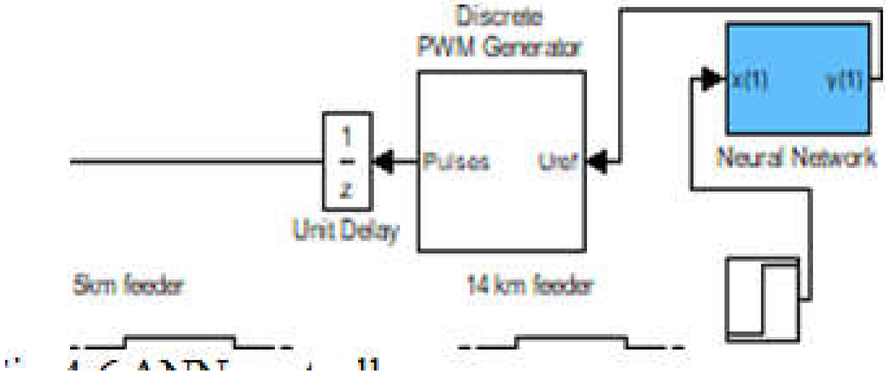

Fig.4.6 ANN controller.

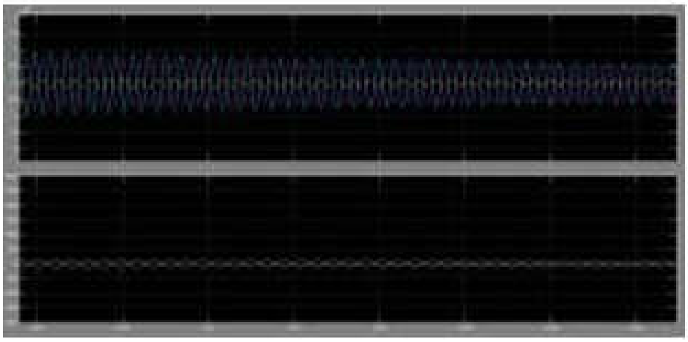

Fig.4.7. Output results.

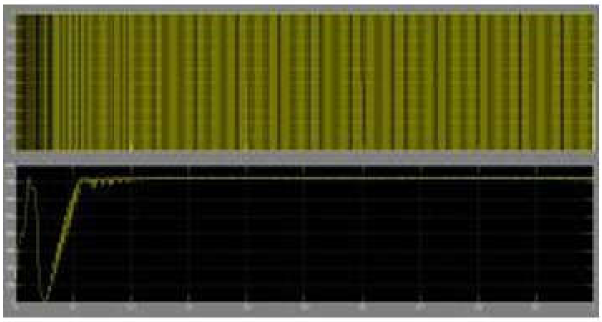

Fig.4.8. Solar panel output with MPPTalgorithm.

CONCLUSION:

For improving the energy efficiency and power quality issues with the increment of the world energy demand, the power generation using the renewable energy source is the only solution. There are several countries located in the tropical and temperature regions, where the direct solar density may reach up to 1000W/m2. Hence PV system is considered as a primary resource. In this paper, the detailed modeling ofgrid connected PV generation system is developed. The DC-DC boost converter is used to optimize the PV array output with the closed loop control for keeping the DC bus voltage to be constant. The 2 level 3- phase inverter is converting the DCinto the sinusoidal AC voltage. The control of the solar inverter is provided through the constant current controller. This controller tracks thephase and frequency of the utility gridvoltage using the Phase- Locked-Loop(PLL) system and generates the switching pulses for the solar inverter. Using this controller the output voltage of the solar inverter and the grid voltage are in phase. Thus the PVsystem can be integrated to the grid. The simulation results the presentedin this paper to validate the grid connected PV system model and the applied control scheme.

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