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POWER MANAGEMENT STRATEY IN GRID CONNECTED PV-WIND HYBRID SYSTEM USING P&O TECHNIQUE

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Abstract:

In contrast to present generation, the wind and the sunrays are accessible at no expense and produce power pollution free. Around early afternoon the WPS fulfills its heap and gives extra energy to the capacity or to the grid. On location energy generation is without a doubt went with minimization of ecological contamination, decrease of misfortunes in power frameworks transmission and dissemination gear, and backings the utility in Demand Side Management. The principle point of this paper is to propose a demonstrating and planning of grid interfaced cross breed solar-wind energy framework. This is an issue particularly in little powerful framework because of the limitation on the inverter markets. Inverters which are used in these sorts of energy frameworks work on grid or off grid. In this investigation, a novel power the board methodology has been created by structuring a wind-PV mixture framework to work both as a self-ruling framework and as a grid-associated framework. The structured Power Management Unit performs estimation from different focuses in the framework and as per this estimation; it gives a compelling energy exchange to burdens and grid. The steadiness of the smaller scale grid, power quality and voltage direction is checked by Matlab reproduction and test results. Watchwords: Wind Energy Conversion Scheme, Photo-Voltaic PV, Smart Grid Interface, Multi-Objective P&O, Efficient Energy Management Controller, and Effective Energy Storage System.

Basically, the main aim of these controller is to provide flexible and robust distributed generation operation control characteristics such as (a) control of PQ and PV in grid connected mode. (b) To provide regulated power under micro-grid. (c) For providing smooth transients between islanding and grid-connected modes and (4) finally, this controller also concentrates on reduction of distortions/harmonics in proposed system which is caused by heavily non-linear loading conditions. The performance of this system is verified by using Matlab/simulink tool box.

Keywords: Power Management, Wind, Solar System, P&O MPPT Technique.

INTRODUCTION:

A sustainable based smaller scale grid will be considered because the key declare manage the energy get to lack to finish energy poorness and the must modification the manners within which we manufacture and devour energy towards cleaner and greener models [1]. For the most half, the sustainable based Energy Management System (EMS) is that the approach adequately and profitably the created power by every inexhaustible supply, for instance, PV, Wind, FC is employed. In order to meet the

required power demand in the present scenario grid interfaced renewable energy is the best solution for the distribution networks. The most important target of the smart grid is to implement an economical EMS to cope with different difficulties of the procedure of the utility grid association whereas optimizing the value of the network operation and increasing the used power generated by every renewable unit of measurement with higher energy internal control for grid stability [2]. to realize these objectives; the subsequent necessary elements should be effectively used within the sensible grid; smart digital activity system and a good energy management system supported artificial intelligent control rule to manage the energy flow and communication network to receive and send all needed info for the energy management system. The smart grid energy system provides the energy management capabilities to the system to receive and deliver power to the utility grid to meet the demand requirements. By the interconnection between hybrid system and grid system, there is a chance to raise the some PQ problems like synchronization, fluctuating system voltage in both magnitude and frequency, harmonic injections, frequency matching at utility grid generation level and consumer level. Additional to the general PQ problems [3], the renewable energy sources are naturally intermittent and therefore the generated power from these sources usually doesn't satisfy or match the facility demand. Therefore, a battery system can be implemented in addition to the renewable sources as a backup purpose and provide reliable operation to the proposed hybrid system.

To accomplish this vision, the DG interface ought to offer high adaptability and strength in meeting an extensive variety of control capacities, for example, consistent exchange between island and grid connected systems; consistent exchange between active/reactive power (PQ) and dynamic power/voltage (PV) methods of operation in the grid connected mode; vigor against islanding recognition delays; offering negligible control-capacity exchanging amid mode move; and keeping up a various leveled control structure [2]. A few control framework upgrades have been made to the progressive control structure to improve the control execution of DG units either in grid-connected or segregated miniaturized scale grid systems.

Configuration of Proposed Hybrid System:

Hybrid power framework which comprises of wind turbines and photovoltaic boards is intended to work either grid-associated or without grid association. Through the as of late created control unit, it is conceivable to check the energy request from self-governing charges, the energy dimension of grid [4-5], the condition of charge of batteries, and the framework can work either autonoumsly or grid-associated inside the edge of control unit. Figure 1, demonstrates the schematic chart for proposed hybrid framework.

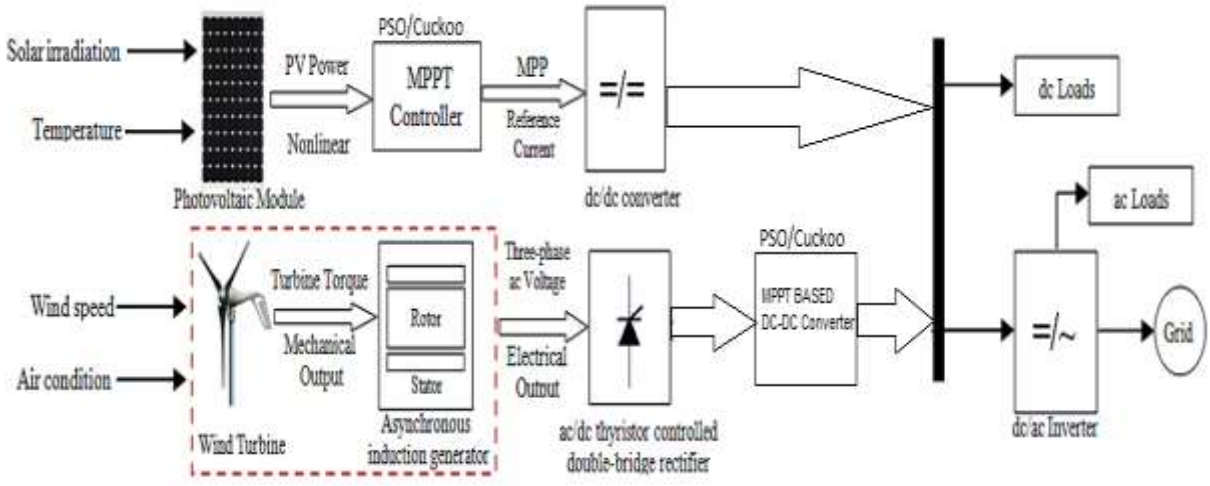

Figure 1: Physical Model for Proposed Wind-PV Hybrid System with MPPT Controller

PV System:

In PV system, the solar cell is the main portion in panel. Figure 2 shows the equivalent electrical PV system for obtaining DC parameters. PV system converts sun irradiance to electrical signal by photon process [5-6]. In this, a mathematical analysis is presented to represent the physical PV system in mathematical model. The Solar Photovoltaic Current is expressed below. The performance characteristics of the PV system is presented in-terms of their I-V and P-V curves as shown in figure 3 and 4 [7].

$$I_{PV} = I_g - I_o\left[\exp^{\left[\frac{eV_T}{KFT_d}\right]} - 1\right] - \frac{V_d}{R_p}$$

Where, I_g= Photocurrent

I_o= Diode Saturation Current

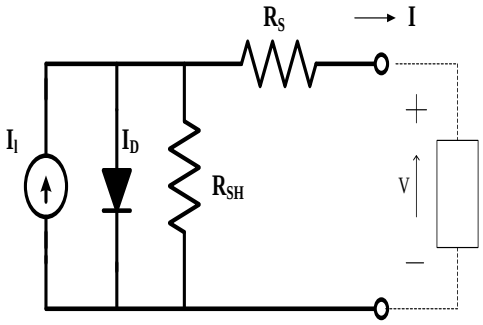

Figure 2 Equivalent Electrical Circuit for Solar Panel

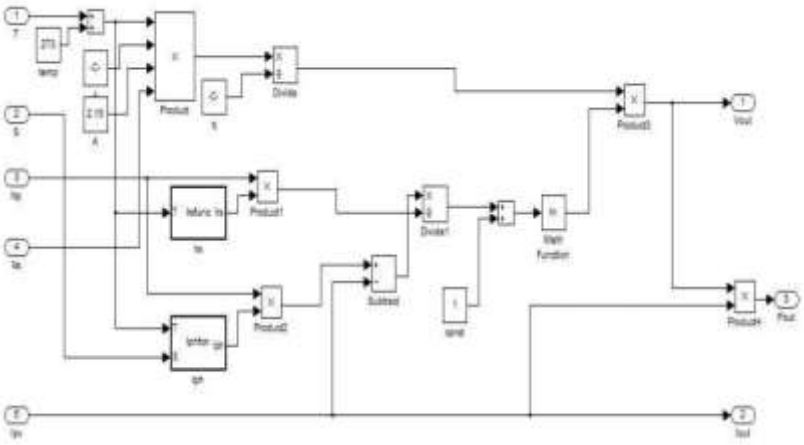

Figure 3: Mathematical Representation for PV System

WIND TURBINE:

Wind energy system is more flexible and reliable than PV System depends on climatic environmental conditions. Wind is freely available in environmental nature as compared to sunshine. Wind turbine blades converts wind energy to kinetic energy and further it converted to electrical energy with the help of generator [8-9]. The structure of wind turbine and its components are shown in figure 5. The performance of wind turbine system is presented in figure 6. It shows the relation between turbine speed Vs Turbine output Power for different values of wind speed.

The kinetic energy causes rotation is given in

$$P_m = \frac{\rho A}{2} V_{wind}^3 C_P(\lambda, \beta)$$

Where, C_p is cofficient of Power.

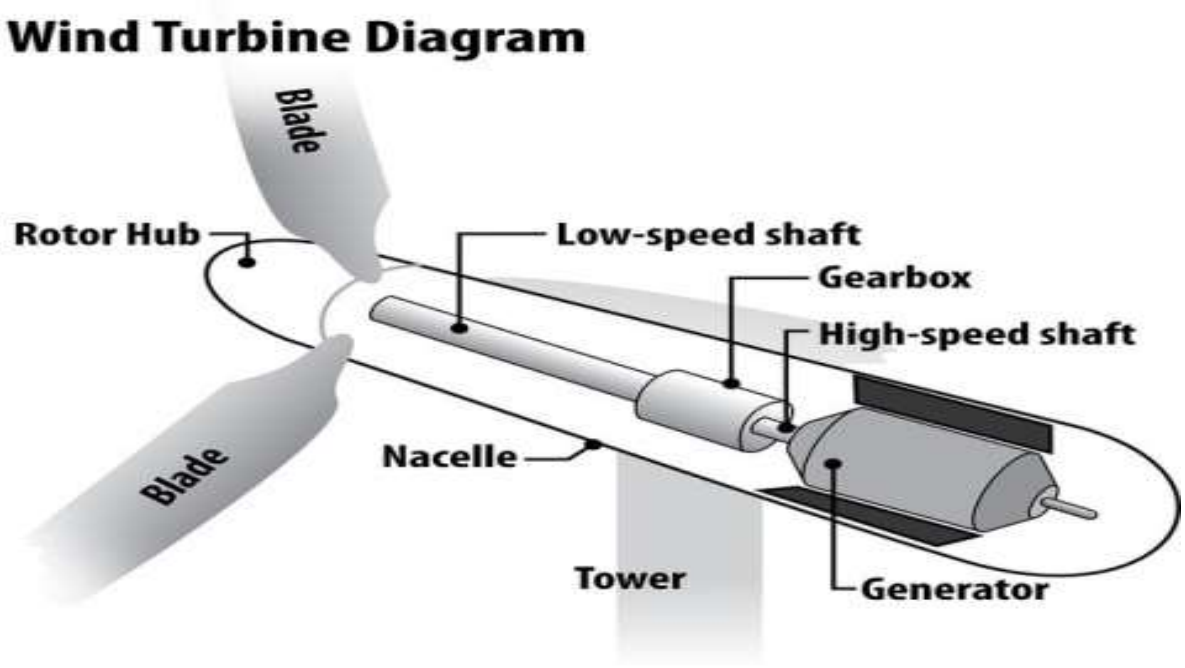

Figure 4: Basic Wind Turbine System

ALGORITHM OF PERTURB OBSERVE METHOD

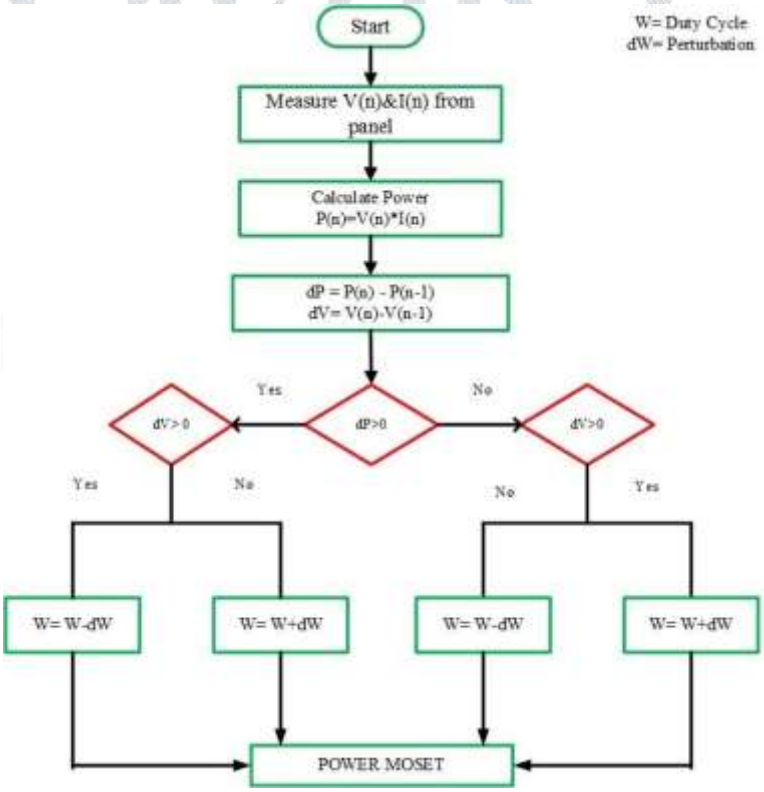

Figure 5: Flow chart of the MPPT algorithm with P&O method.

By comparing the recent values of power and voltage with previous ones, the P&O method shown in the flow chart can determine the value of reference current to adjust the output power toward the maximum point [4].

MPPTs can be designed to drive an electric motor without a storage battery. They provide significant advantages, especially when starting a motor under load. This can require a starting current that is well above the short-circuit rating of the PV panel. A MPPT can step the panel's relatively high voltage and low current down to the low voltage and high current needed to start the motor.

Once the motor is running and its current requirements have dropped, the MPPT will automatically increase the voltage to normal. In this application, the MPPT can be seen as an electrical analogue to the transmission in a car; the low gears provide extra torque to the wheels until the car is up to speed**.**

MATLAB EXPERIMENTAL RESULTS:

The hybrid pv-wind system with different MPPT controllers is practically tested and verified using MATLAB/Simulink software tool.

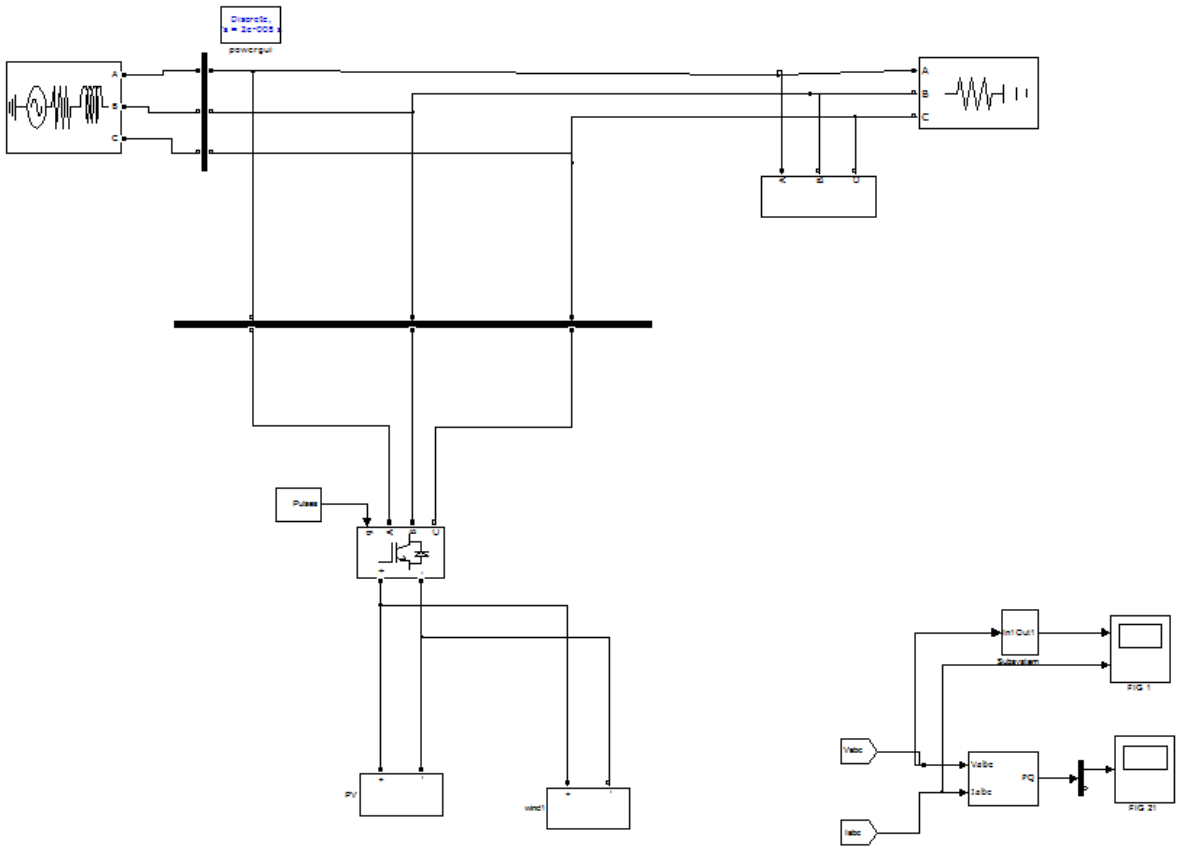

Figure 6: Simulation Diagram for Proposed PV-Wind Hybrid System

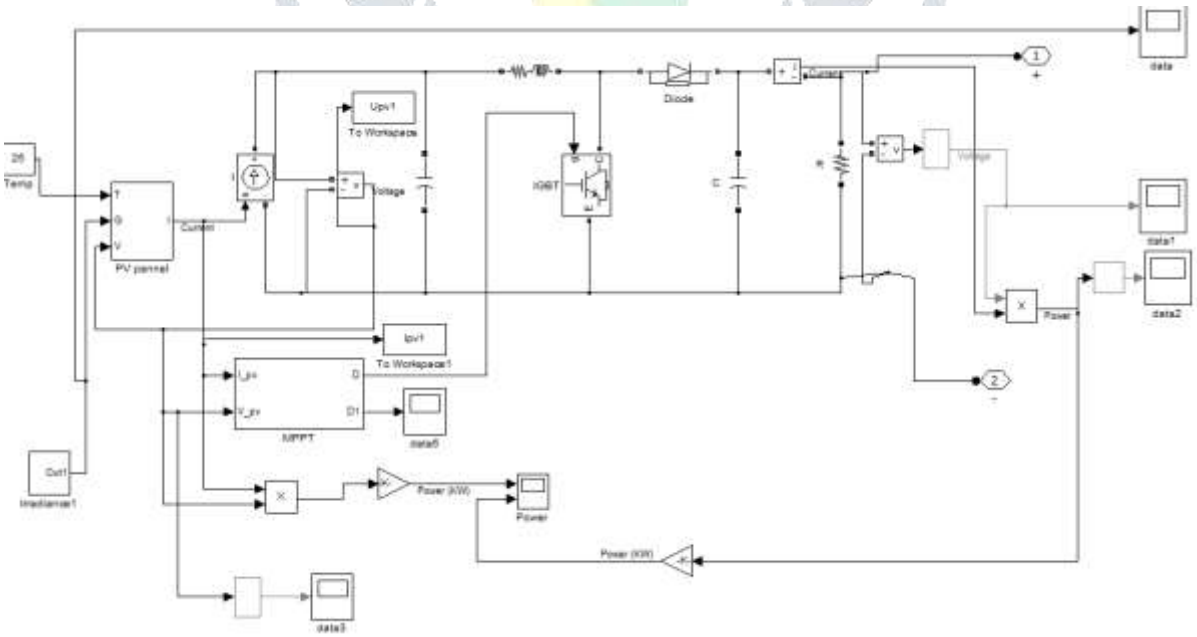

Figure 7: Simulation Model for Designing of PV System

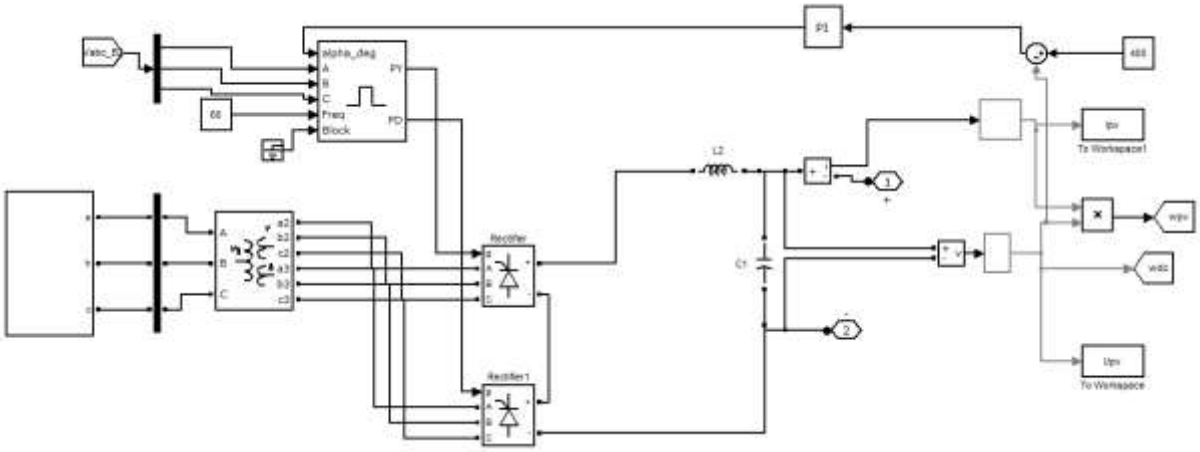

Figure 8: Simulation Model for Designing of Wind Turbine System

This case is implemented and tested with basic perturb and observe MPPT technique for Solar system and the results for various cases are shown below.

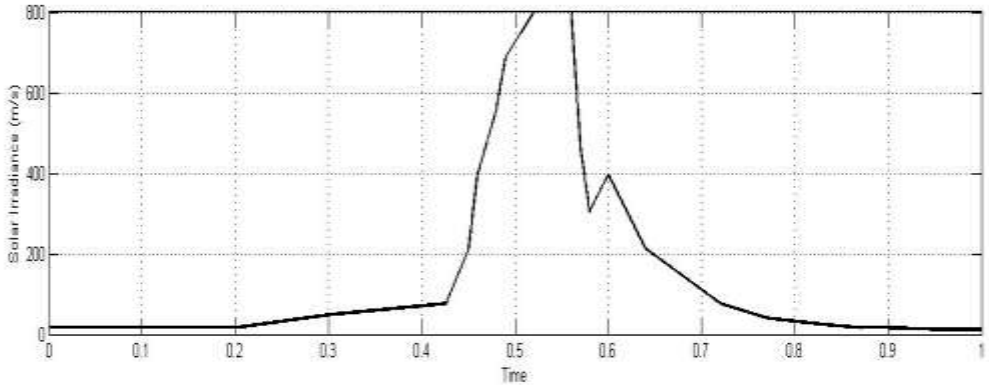

Figure 9: Simulation waveform for Solar Irradiance

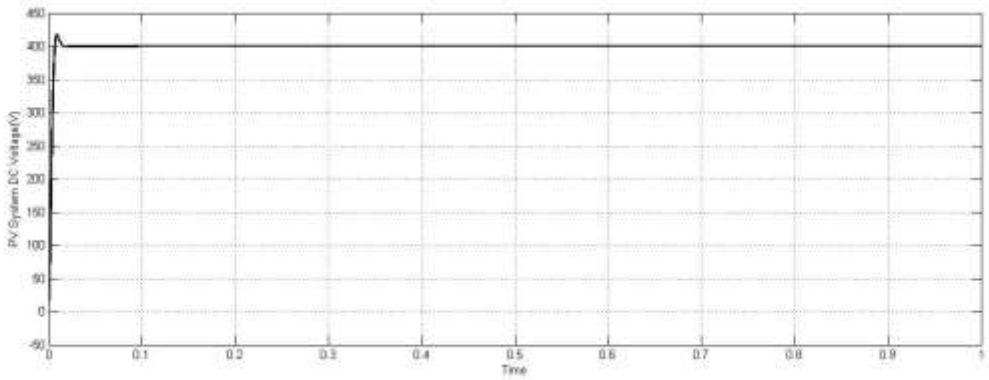

Figure 10: Simulation waveform for Solar System DC Link Voltage with Perturb & Observe MPPT Controller

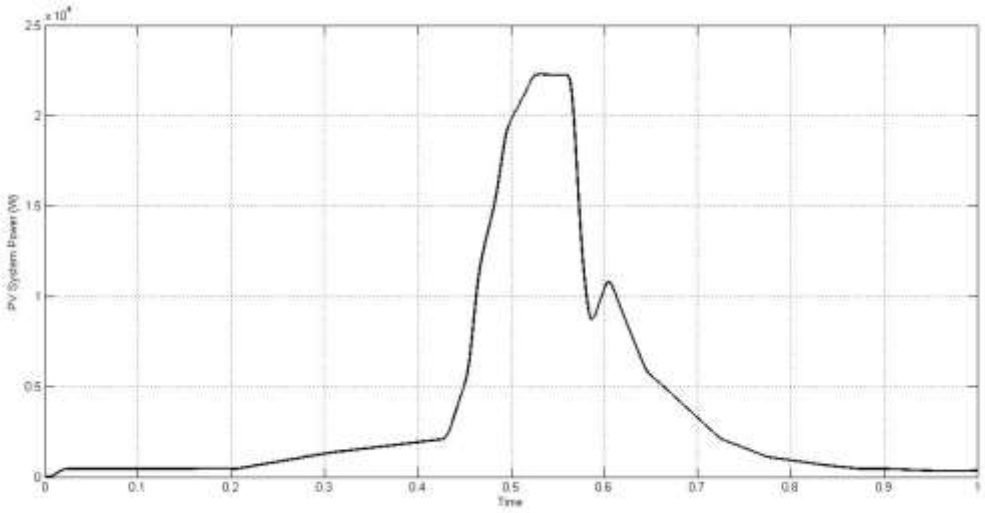

Figure 11: Simulation waveform for Solar System DC Power with Perturb & Observe MPPT Controller

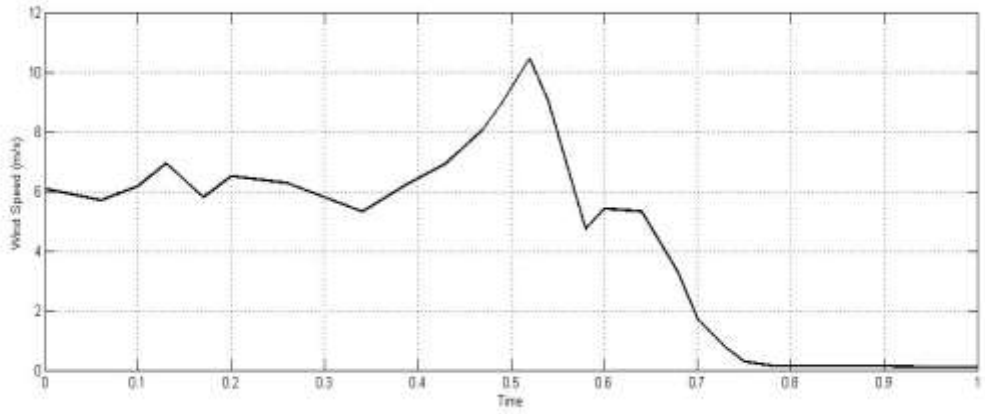

Figure 12: Simulation waveform for Wind System Speed

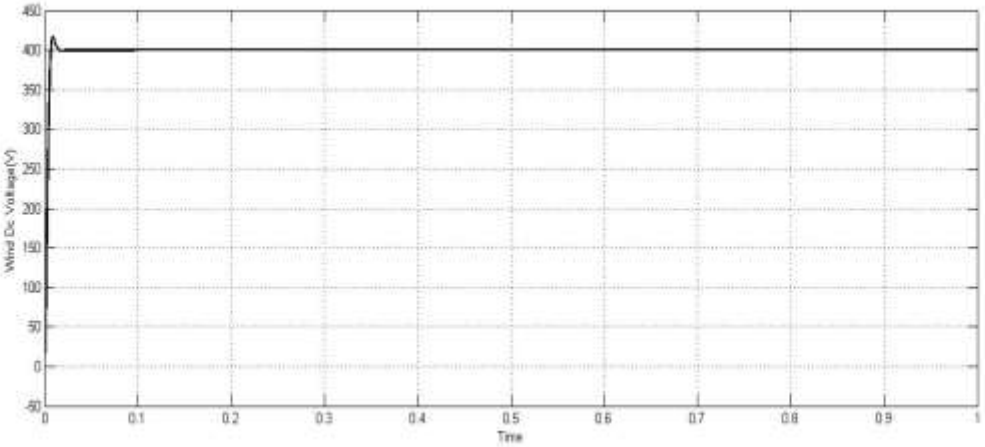

Figure 13: Simulation waveform for Wind System DC Link Voltage with Perturb & Observe MPPT Controller

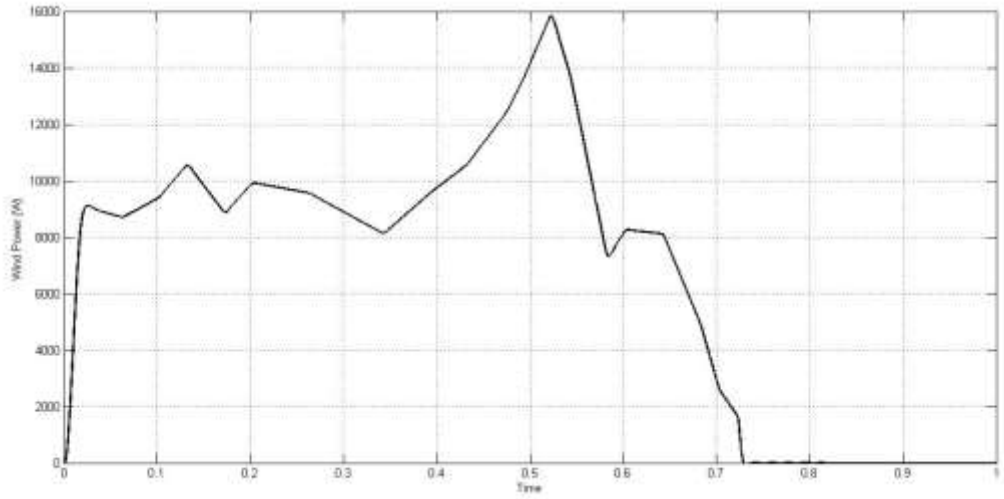

Figure 14: Simulation waveform for Wind System DC Power with Perturb & Observe MPPT Controller

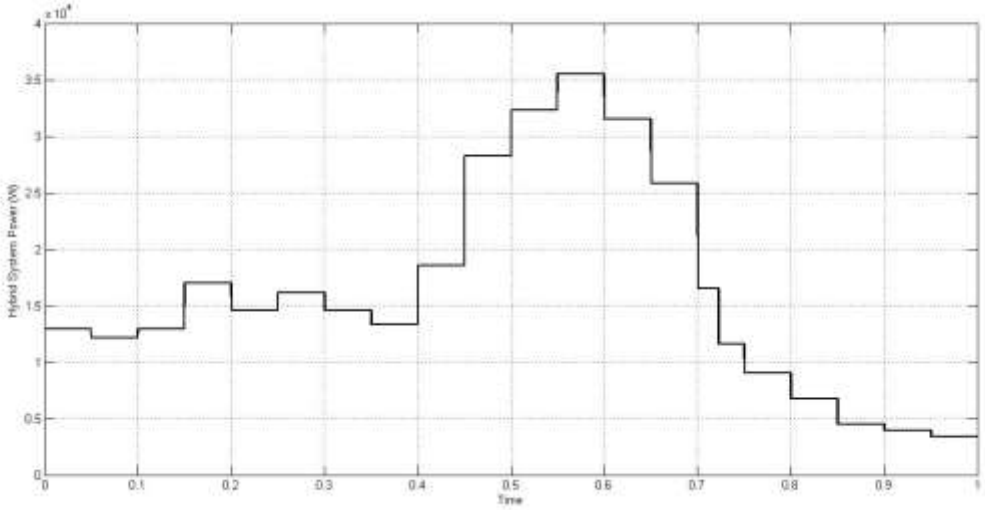

Figure 15: Simulation waveform for Hybrid System Power with Perturb & Observe MPPT Controller

The Matlab Experimental results for Hybrid pv-wind system under Perturb & Observe MPPT controller is shown in figure 10-15 for both wind and pv parameters. From the above result the wind and PV powers are changes w.r.t changes in the input data.

CONCLUSION:

A Power Management Strategy for Hybrid Grid interconnected PV-Wind Energy system is proposed in this paper. For an effective power management this paper is also implemented with MPPT techniques like PSO and Cuckoo Search algorithms The proposed PSO and Cuckoo based MPPT calculations involves the framework parts and furthermore balance the power stream. The accessible power from the PV item is profoundly dependent on solar radiation. To beat this absence of the PV framework, the PV module was incorporated with the wind generator framework. The dynamic execution of the proposed energy the executives framework dependent on MPPT with its control and correspondence framework is tried tentatively and utilizing SIMULINK under genuine record of climate examples and load conditions. The near outcomes for the proposed framework with various MPPT controllers is appeared.

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