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PV BASED WATER PUMPING SYSTEM WITH GRID SUPPORT

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***Abstract*—This project displays the sunlight based PV (Photo Voltaic) provided PMSM (Permanent Magnet Synchronous Motor) drive for water pumping system. Pumping water is an all-inclusive requirement for horticulture and the utilization of PV boards is a characteristic decision for such applications. The fast Photo voltaic (PV) permanent magnet synchronous engine (PMSM) drive is explored in one case and in other case the power is exchanged to Grid. Three stage VSI-1 (Voltage Source Inverter) is controlled to supply PMSM, to manage release of water and VSI-2 is controlled to supply energy to the network through PLL (PHASE LOCKED LOOP). Simplified control is utilized for the smooth operation. PV water-pumping is profoundly aggressive contrasted with conventional vitality advances and most appropriate for remote site applications that have little to direct power necessities and can yield income for providing energy to the lattice. Sunlight based PV water pumping system utilizing PMSM drive with a discretionary power supply to the system is displayed in MATLAB/SIMULINK condition utilizing the sum-control system tool kits. The execution of the proposed system is obtained independently.**

Index terms—*DC-DC Boost converter, PMSM drive, photo voltaic, water pumping system.*

I. INTRODUCTION

In the present scenario the power demand of the world is ever increasing at a swift rate. The world is now in search for renewable energy sources other than fossil fuels[1]. The conventional fossil fuels offer a short-term solution to this energy scarcity; they will release the more amounts of carbon dioxide and other greenhouse gases. This lead to pave a new path for study on renewable energy sources and other research advancements in the field of power electronic devices and hence, by decreasing the cost of utilizing the renewable energy to make it nearer to everyone. Solar energy is one of such renewable energy gives ample amount of energy for meeting our power demands. Photo-voltaic (PV) arrays consisting of PV modules to produce an eco-friendly power and they are gaining a very wide acceptance and more recognition with a very good growth with time. The PV module comprises of more sun based cells, which will change episode day lights specifically into power, and are coupled as required to give wanted levels of DC current and voltage by connecting them in parallel or in a serial. The solar PV cells will generate electric current due to a quantum-mechanical process very known as the "Photovoltaic effect".

There are two main disadvantages with these PV systems

1) Cost of PV modules is much more related to the existing conventional sources such as fossil fuels and

2) The efficiency is also quite low when compared to other source.

In this modern world, power semiconductor devices are treated as the heart of the power electronics, and are very widely used in most of the power electronic converters to form many topologies according to design specifications to on or off switches, and help to transform power from one form to another.

There are four main such basic transformation forms that normally can be applied such as AC-AC, AC-DC, DC-AC and DC-DC. Inverter belongs to the converter family called DC to AC converter. It transforms DC power to AC power, which is symmetrical AC output voltage at our specified frequently.

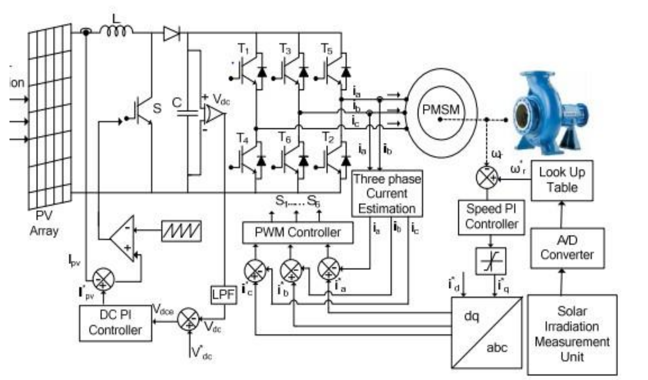

Fig1. Schematic diagram of standalone solar PV based PMSM drive for water pumping system.

In recent days, majority of people are installing solar panels to generate power at their own homes to achieve their own power demands.

The main drawback to harvest more energy is that we need to use maximum no of storage batteries to store the energy which is not economical, needs more money and space to batteries and all. In order to achieve the drawback, designed a grid tied inverter (GTI)[2]. Which gives a solution to all problems associated with standalone inverters? GTI's are a power electronic converter which converts the generated solar direct current into alternating current and by using zero crossing detector the power is straight inserted into grid.

The main advantage of using GTI is directly the power is injected to the grid and by using net- metering techniques anyone can turn into revenue by generating power at their own roof-tops. The main thing is achieving a harmonic free GTI which will not disturb the system.

The main aim of this paper is to achieve a pure sinusoidal AC supply which will inject to the grid directly. The switching methodology used for inverter switching is third harmonic pulse width modulation. Because of the issues related with the exchanging misfortunes, the quantities of heartbeats related with each cycle likewise get influenced. The utilization of high recurrence exchanging procedure will prompt the powerful misfortunes and lessens proficiency. It is additionally should be take on the inverter exchanging plan.

The elements are to be considered keeping in mind is to meet the necessity.

1. Cost of equipment.
2. Size of filter
3. Total harmonic distortion
4. Power loss in switching elements.

To fulfill the above specified conditions the adopted switching technique is third harmonic injection pulse width modulation in this thesis work. The filter used in this circuit is T-LCL filter which will reduce the harmonic content associated with the inverter and thereby stabilizing the system.

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II. INVERTER CONTROL

While playing out the power system operation, the inverter is effectively controlled such that it generally draws/supplies dynamic power to/for the grid. In this manner the yield of dc-connect voltage controller brings about a dynamic current (Im). The dynamic current part (Im) with single grid voltage vector formats[3]. The distinction of this sifted dc- connect voltage and reference dc-link voltage (Vdc*) is given to a discrete-PI controller to keep up a steady dc-connect voltage under fluctuating and conditions are given.

The exchanging example of each IGBT inside inverter can be detailed of the premise of blunder amongst actual and the reference currents of inverter, which can be clarified as: In the event that, upper turn will be OFF and bring down switch will be ON in the stage "a" leg of inverter. On the off chance that, then upper switch will be ON and bring down turn will be OFF in the stage "a" leg of inverter. 5.5 SWITCH SELECTION Two main types of switches are used in power electronic.

III. BOOST CONVERTER CONTROL

The boost converter is used to feed the active power from PV array to the DC link capacitor connected VSI fed PMSM. The design parameters of the boost converter are maximum current through boost converter IGBT's where ipp is peak to peak ripple current considering 10% ripple 25 A, 600 V IGBT is used for boost converter. The DC bus voltage and the output of the DC PI controller is used to estimate the DC voltage error at the kth sampling instant is as, where Vdc and V*dc are sensed and reference DC bus voltages respectively. The output of the DC PI controller at the kth sampling instant is expressed as, the DC bus voltage errors in the kth and (k-1)th sampling instant.

The reference and actual PV bus current are used to estimate the PV bus current error at the kth sampling instant. The PV bus current error (Ipve) is amplified using gain K and compared with fixed frequency carrier signal to generate switching signals for IGBT used in boost converter.

IV. RESULTS AND ANALYSIS

During the starting of PMSM drive, it is observed that the DC link voltage is maintained constant and motor allows developing rated torque.

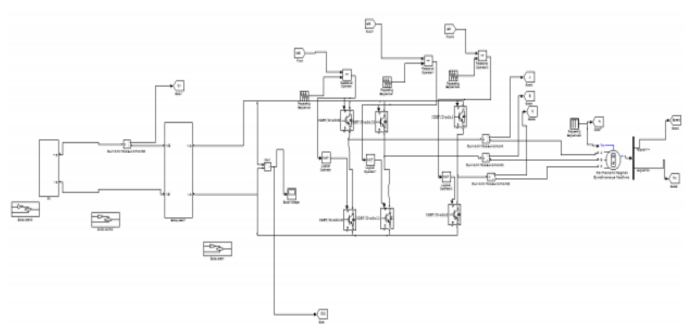

Fig 2 performance of PV based PMSM drive under starting.

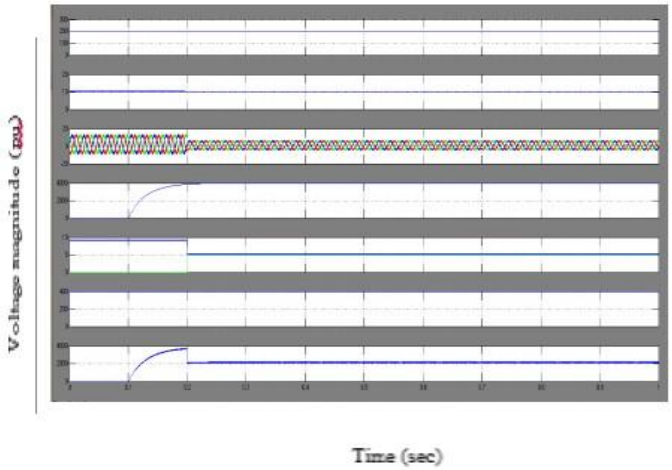

Fig 3 Trasient performance of PV based PMSM drive

At 0.2s, a step change in PV radiation from 1000 to 900 W/m2 . It leads to instantaneous change in electromagnetic torque of PMSM due to which the PMSM starts deaccelerate and it is achieved the desired speed within 20ms.

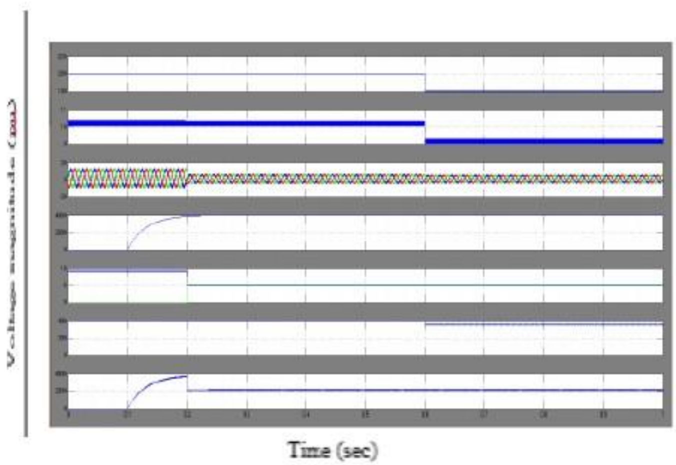

Fig 4 performance of PV based PMSM drive under starting.

A RES with output is on dc-link grid-interfacing inverter. The waveforms Grid voltages and active-reactive powers are shown in Figures. Values of powers imply powers flow.

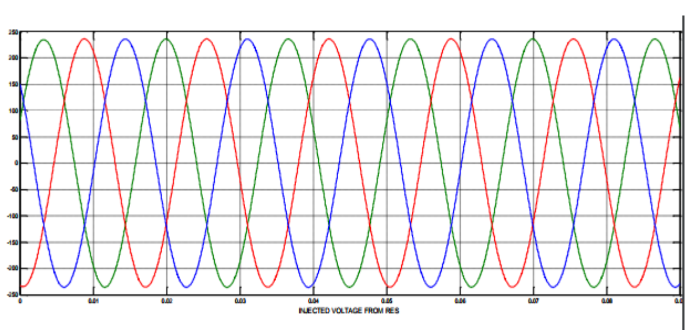

Fig 5 Output voltage waveform of Grid interface inverter

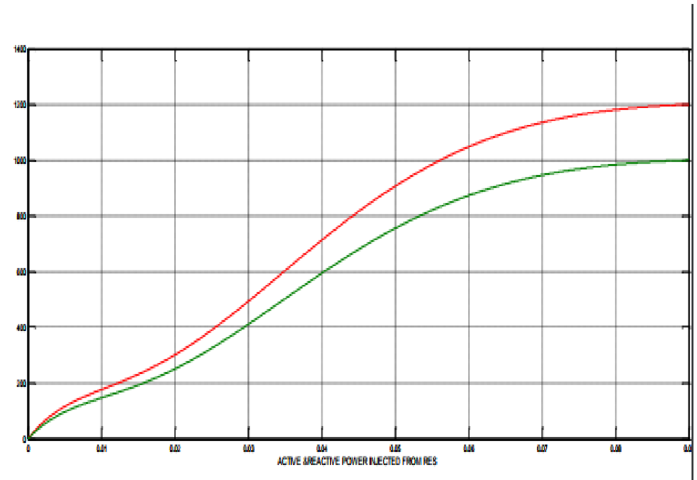

Fig 6 output waveform of active and reactive power

V. CONCLUSION

A sun powered PV framework has been displayed for the Case 1: PMSM drive is utilized as a part of water pumping framework. Sun powered PV water-pumping frameworks are basic, dependable, save vitality and need less upkeep. It has been demonstrated that proposed system provide satisfactory control on motor speed for water pumping and simulated results.

Case 2: The solar PV system is used to transfer the power to the grid, when motor is off.. The controller must act to maintain the DC bus voltage constant as possible and improve the stability of the whole system.

Network associated photovoltaic power frameworks which have a limit more than 1 kilowatts can meet the benchmarks. They can encourage energy to the lattice. The vitality delivered by the boards can yield income by pitching it to the matrix. Contingent upon their concurrence with their neighborhood matrix vitality organization.

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