# Photovoltaic Water Distributing System using Variable - Frequency (V/F) Controller

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***Abstract -*** A simple and efficient solar photovoltaic (PV) water pumping system utilizing an induction motor drive (IMD) is presented in this paper. This solar PV water pumping system comprises two stages of power conversion. The first stage extracts the maximum power from a solar PV array by controlling the duty ratio of a dc-dc boost converter. The dc bus voltage is maintained by the controlling the motor speed. This regulation helps in the reduction of motor losses by reducing motor currents at higher voltage for the same power injection. To control the duty ratio, an incremental conductance based maximum power point tracking(MPPT) control technique is utilized. The proposed system is modelled, and its performance is simulated in detail. The scalar control eliminates the requirement of a speed sensor/encoder. Consequently, the need of motor current sensor is also eliminated. Moreover, the dynamics are improved by an additional speed feed forward term in the control scheme. The proposed control scheme makes the system inherently immune to the variation in the pump constant. The prototype of PV-powered IMD emulating the pump characteristics is developed
In the laboratory to examine the performance under different operating conditions

***Keywords*** -Photovoltaic cells,(MPPT)maximum power point tracking, waterpumping, scalarcontrol,(IMD) induction motor drives

## I. INTRODUCTION

Photovoltaic is the field of technology and research related to the devices which directly convert sunlight into electricity. The solar cell is the elementary building block of the photovoltaic technology. Solar cells are made of semiconductor materials, such as silicon. One of the properties of semiconductors that makes them most useful is that their conductivity may easily be modified by introducing impurities into their crystal lattice. For instance, in the fabrication of a photovoltaic solar cell, silicon, which has four valence electrons, is treated to increase its conductivity. On one side of the cell, the impurities, which are phosphorus atoms with five valence electrons (n-donor), donate weakly bound valence electrons to the silicon material, creating excess negative charge carriers. On the other side, atoms of boron with three valence electrons (p-donor) create a greater affinity than silicon to attract electrons. Because the p-type silicon is in intimate contact with the n-type silicon a p-n junction is established and a diffusion of electrons occurs from the region of high electron concentration (the n-type side) into the region of low electron concentration (p-type side). When the electrons diffuse across the p-n junction, they recombine with holes on the p-type side. However, the diffusion of carriers does not occur indefinitely, because the imbalance of charge immediately on either sides of the junction originates an electric field. This electric field forms a diode that promotes current to flow in only one direction. Ohmic metal-semiconductor contacts are made to both the n-type and p-type sides of the solar cell, and the electrodes are ready to be connected to an external load.

## II. PV DISTRIBUTING SYSTEM

In PV distributing (PV) systems, an induction motor drive (IMD) shows good performance as compared to other commercial motors because of its rugged construction. The evolution is intended to develop productive, reliable, maintenance-free and cheap PV water pumping system. However; new permanent magnet motors such as brushless DC motor and permanent magnet sine fed motors are used into pumping, but are still overshadowed by induction motor because of cost and availability constraint. Moreover, the manufacturing of the induction motor is in matured stage giving an edge to its use in developing countries for solar water pumping application. With the emergence of outperforming solid state switches, high speed processors andEfficient motor control algorithms, IMD based water pumping systems have taken a step ahead to conventional water pumping systems. Moreover, PV array fed IMD has performed ruggedly in the field of pumping system by utilizing a VSI (Voltage Source Inverter). The proposed work deals with a three-phase IMD for solar water pumping, which meets the requirement of life without electricity in remote locations. The initial cost of solar power plant is high. Therefore, once the plant is installed, the focus is to obtain the peak power from the solar panels of the installed capacity. The developed water pumping system powered directly from PV array requires MPPT algorithms to operate under different irradiation levels and to extract the peak power from a solar PV array. Some of these, MPPT algorithms are recommended. A comparative study on different MPPT techniques is provided. From operational point of view, MPPT is a mandatory segment of a PV system. The substantial research is reported in past few years in the area of MPPT. In this paper, an INC

(Incremental Conductance) based technique is used to obtain the peak power from the solar PV array. Therefore, the proposed PV fed water pumping system produces peak torque even at low radiation. The INC technique is based on the comparison of output conductance of solar PV array to the incremental conductance. As compared to solar PV grid interfaced systems [5], the major challenge in PV water pumping is timely control of active power.

## III. INDUCTION MOTOR

An induction motor or asynchronous motor is a type of alternating current (AC) electrical motor that uses the principles of induction motors to produce power. Induction motors operate by mechanically turning their rotors faster than synchronous speed. A regular AC asynchronous motor usually can be used as a motor, without any internal modifications. Induction motors are useful in applications such as mini hydro power plants, wind turbines, or in reducing high-pressure gas streams to lower pressure, because they can recover energy with relatively simple controls. An induction motor usually draws its excitation power from an electrical grid; sometimes, however, they are self-excited by using phase-correcting capacitors.. An induction motor produces electrical power when its rotor is turned faster than the synchronous speed. For a typical four-pole motor (two pairs of poles on stator) operating on a 60 Hz electrical grid, the synchronous speed is 1800 rotations per minute (rpm). The same four-pole motor operating on a50 Hz grid will have a synchronous speed of 1500 RPM.

## IV. SIMULATION WORK

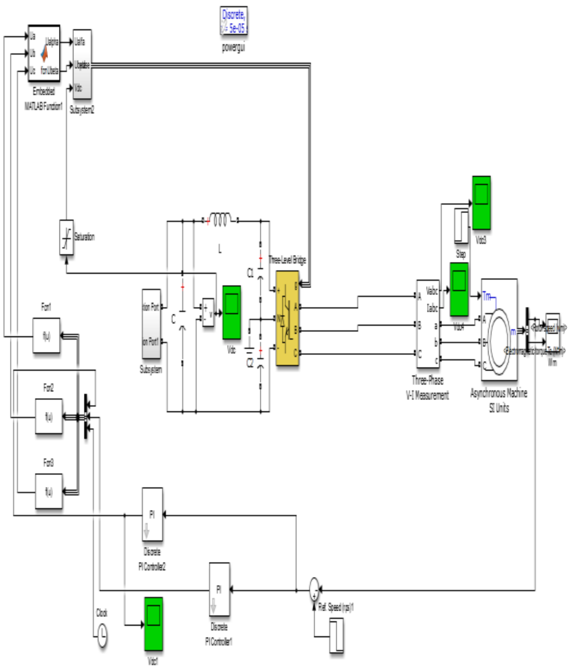

Figure 1

**Solar mppt with boost converter**

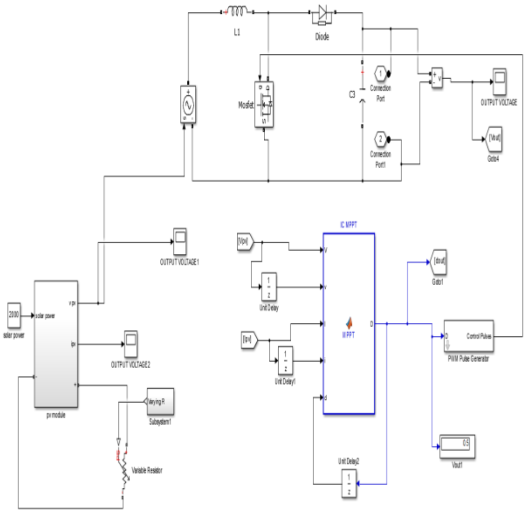

Figure 2

**Solar Cell**

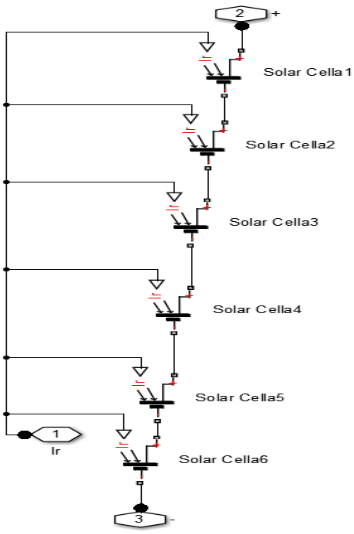


Figure 3

## V. WAVEFORMS

**Solar Input**

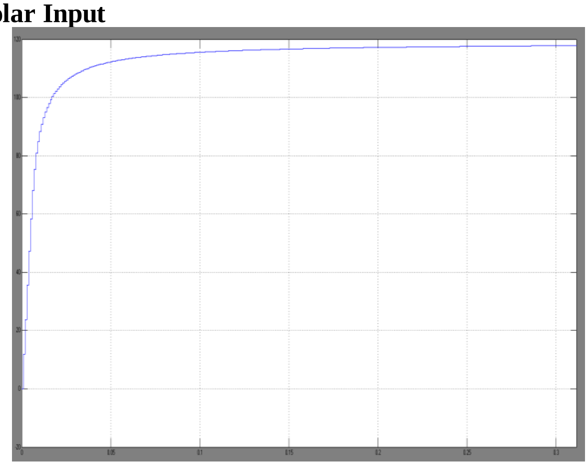

Figure 5

**Boost output**

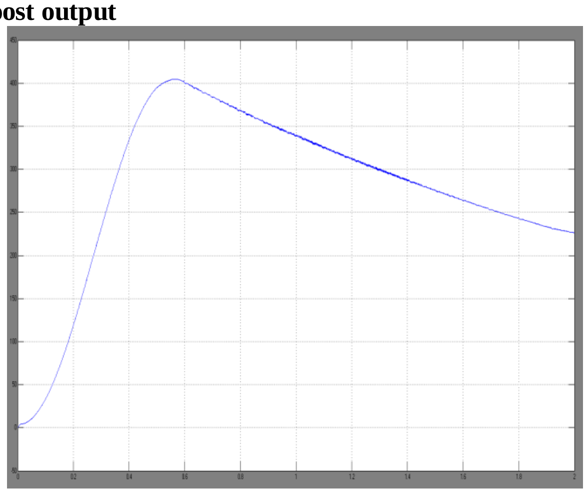

Figure 4

**Inverter voltage**

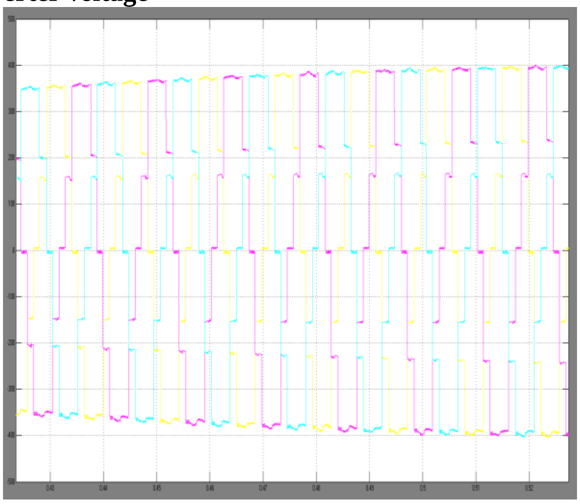

Figure 6

**Inverter current**

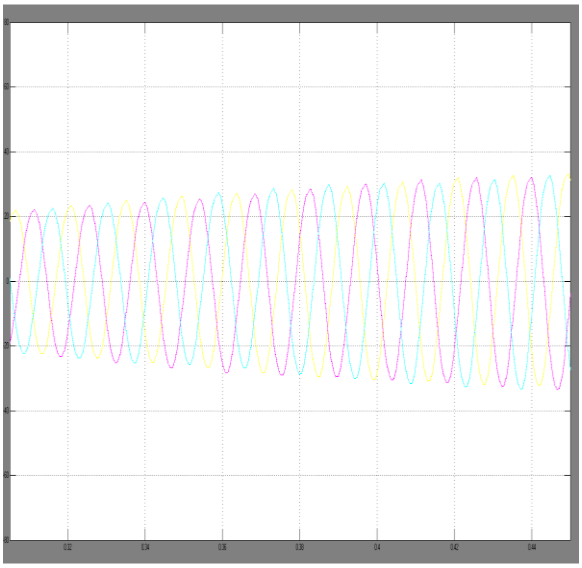

Figure 7

**Electromagnetic torque**

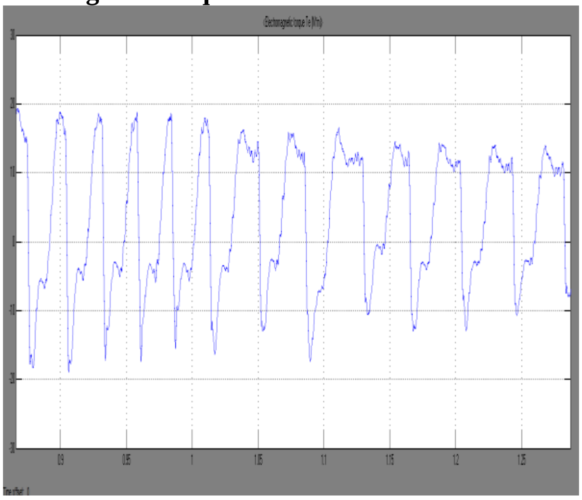

Figure 9

**Motor speed**

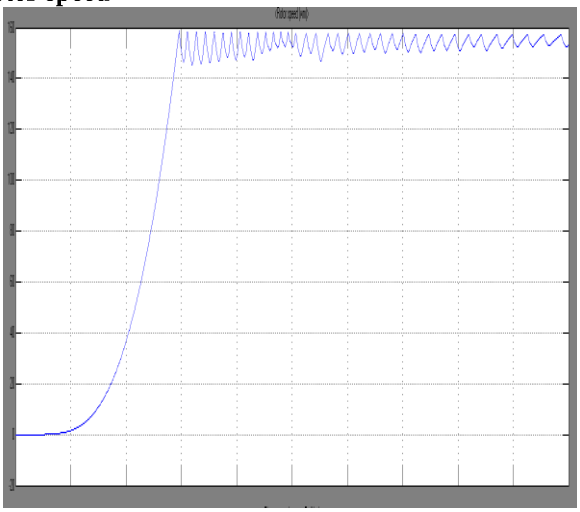

Figure 8

**Hardware Output:**

Figure 9

## VI. CONCLUSION

This paper presented a review of wireless charging of electric vehicles. It is clear that vehicle electrification is unavoidable due to environment and energy related issues. Wireless charging will provide many benefits compared to wire charging. In particular, when the roads are electrified with wireless charging capability, it will provide the foundation for mass market penetration for EV regardless of battery technology. With technology development, wireless charging of EV can be brought to fruition. Further studies in topology, control, inverter design, and human safety are still needed in the near term.

## VII. REFERENCES

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