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SPEED CONTROL OF INDUCTION MOTOR FED FROM SOLAR PHOTOVOLTAIC ARRAY

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Abstract_ PV array is increasingly employed for water pumping system. In this paper, the developed boost converter step up the voltage generated by the PV array to run a three-phase induction motor. Sinusoidal pulse width modulation (SPWM) technique is used in inverter to convert DC to AC and LC filter is used to reduce the harmonics content in the output voltage which can be directly used to drive a three-phase induction motor and pump system. Experimental investigation presented gives the utility of such a drive system. A design of directly coupled solar water pumping system powered from photovoltaic panels, DC to DC Boost converter, full bridge sinusoidal pulse width modulation (SPWM) inverter, LC filter, induction motor and centrifugal pump is presented. PI controller is used to maintain the output voltage constant.

INRODUCTION

PV water pumping systems generally consist of PV array, controller, inverter, motor, pump and water storage tank. Photovoltaic water pumping systems are particularly suitable for water supply in remote areas where the electricity is not available. Water can be pumped during the day and stored in tanks, making water available also at night or when it is cloudy. The pumped water can be used in many applications such as domestic use, water for irrigation and village water supplies. The advantages of using water pumps powered by photovoltaic systems include low maintenance, ease of installation, reliability and the matching between the powers generated and the water usage needs. In addition, water tanks can be used instead of batteries in photovoltaic pumping systems.

I. PHOTOVOLTAIC ARRAY

The photovoltaic system,also PV system or solar power system ,is a power system designed to supply usable solar power by means of photovoltaics.Itconsists of an arrangement of several components,including solar panels to absorb and convert sunlight electricity,a solar inverter tochange the electric current from DC toAC,as well as mounting,cabling,and other electrical accessories to set up a working system.

II. PROPOSED SYSTEM

It is proposed to speed control of induction motor. . The induction motor is driven by a full bridge single phase sinusoidal pulse with modulation (SPWM) inverter whose firing strategy has been designed so as to eliminate lower order harmonics. This helps in reducing torque pulsations and unnecessary heating caused by harmonic currents and also improves system efficiency. The inverter used in the above manner has no control on the fundamental voltage content, hence dc input voltage of the inverter has to be controlled. This is achieved by a DC to DC chopper.

.chopper not only helps to vary the fundamental component at the inverter output but can be controlled to track and extract maximum isolation power from the solar cells. This paper also presents the design and analysis of a LC output filter for use with MOSFET-based motor drive inverters. The LC filter is used to limit the rate of rise of the inverter output voltage and reduce common mode noise to the motor.

III. BLOCK DIAGRAM

This figures shows the block diagram of solar photovoltaic array

3.1 SOLAR PANEL

Solar panel refers to panel designed to absorb the sun's rays as a source of energy to generate the electricity. Poly crystalline type solar panel is used in this project. The solar panel generates 18Vdc supply.

3.2 DC-DC CONVERTER

The DC-DC converter is used in the proposed system in order to provide the constant DC power supply to inverter. The DC-DC converter used in this system is boost converter of 18 volt. The proposal also incorporates the design of boost DC-DC converter of 18volt for providing the constant 18 volt power supply for inverter.

3.3 INVERTERS

A DC to AC converter is also called as inverter, which converts a DC quantity into AC quantity. There are two types of inverters namely a voltage source inverter and a current source inverter. voltage source inverter is the most commonly used inverters.

3.4 LC FILTER

In filter designing, the first step is finding the best filter. The second step is calculating the designed impedance from the lowest voltage (Vmin) divided by the highest current (Imax) where is Rd. the third step is equating the inductor (L) and the capacitor (C) values from the second step using the following equation [4]. The design impedance form can be calculated by using the below equation. Rd = Vmax/Imax

The inductance (L) and the capacitance (C) values of the filter can be calculated by

L = Rd/ 2pi*f **C = 1/2piRd**

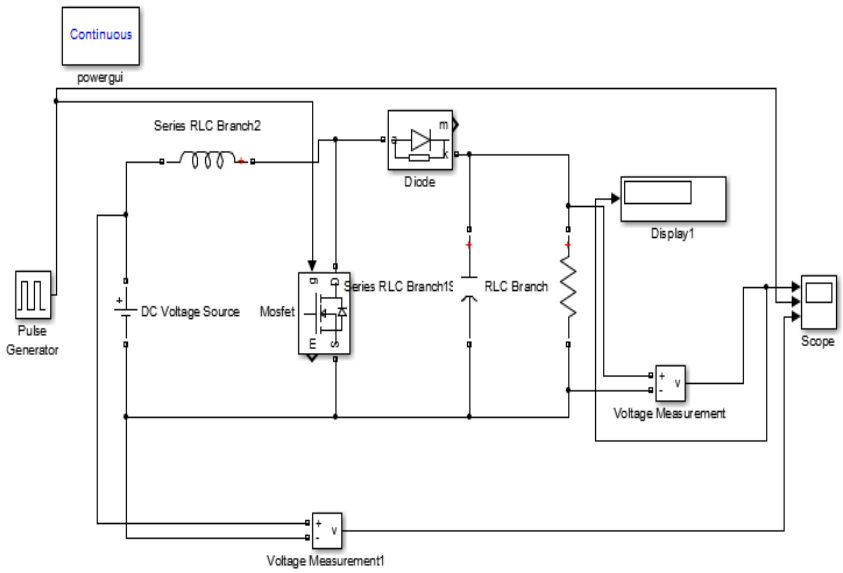
3.5 PI CONTROLLER

A proportional–integral controller (PI controller) is a generic control loop feedback mechanism (controller) widely used in industrial control systems. A PI controller attempts to correct the error between a measured process variable and a desired set point by calculating and then outputting a corrective action that can adjust the process accordingly. The PI controller calculation involves three separate parameters. Show Proportional, the Integral values.

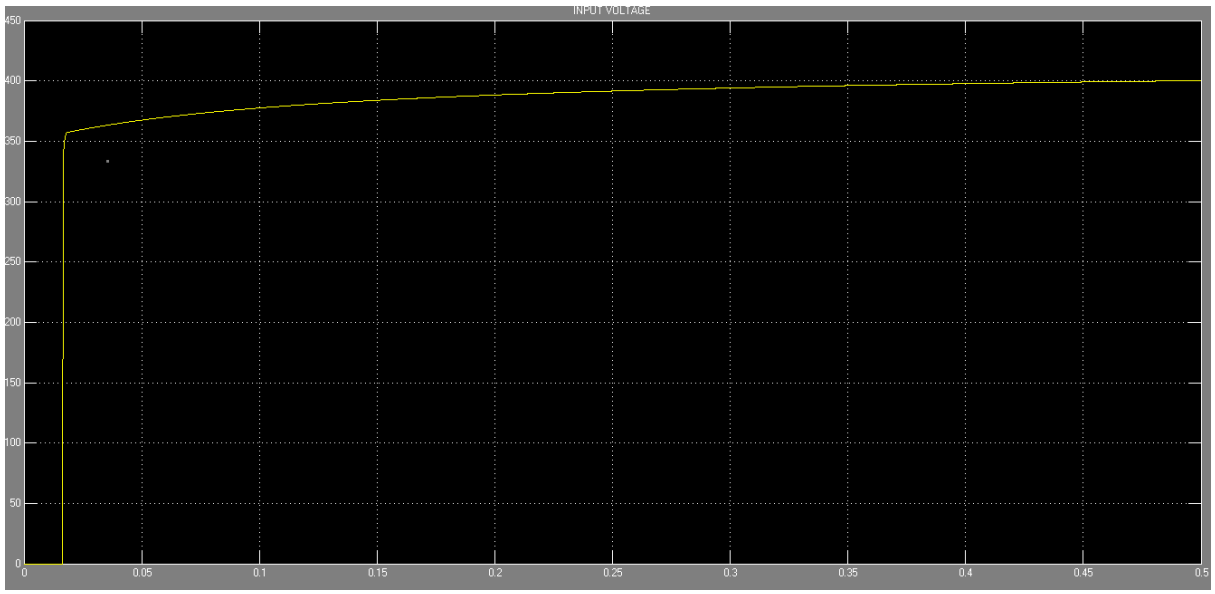
3.6 INDUCTION MOTOR

Induction motor is an ac. motor in which currents in the stator winding (which is connected to the supply) set up a flux which causes currents to be induced in the rotor winding ; these currents interact with the flux to produce rotation Also called asynchronous motor. The rotor receives electrical power in exactly the same way as the secondary of a two winding transformer receiving its power from primary. That is why an induction motor can be called as a rotating transformer i.e., in which primary winding is stationary but the secondary is free to rotate.

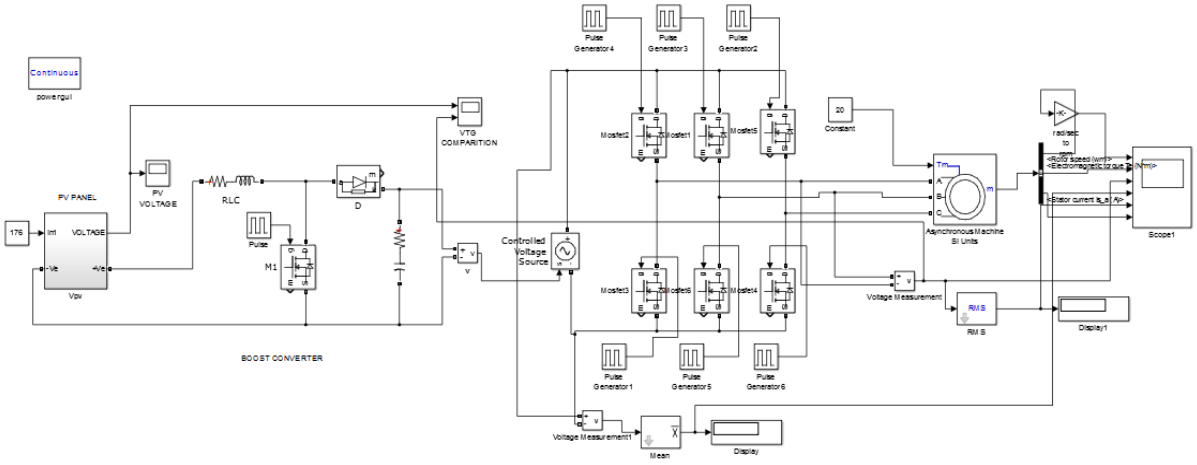
IV. SIMULATION OUTPUT



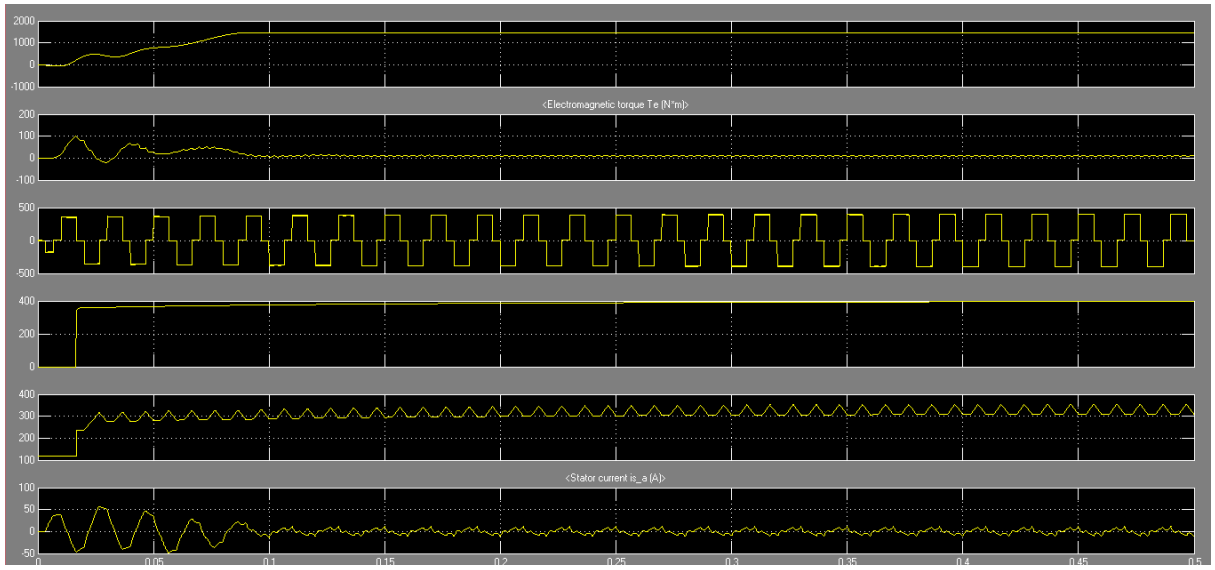
Simulation diagram for boost converter



Simulation output for boost converter



Simulation diagram for induction motor



Simulation output for induction motor

CONCLUSION

Thus the solar based to control the speed of an induction motor is designed by using boost converter and inverter circuit. Boost converter is designed for boosting voltage from the solar panel 18v to 20v. Hence the efficiency of the converter becomes high. The inverter circuit is designed by using mosfet's. It is capable of converting 400v dc to 360ac voltage. The voltage will be varied then frequency also varied so the frequency will not constant.

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