

Simulation of Three Phase Induction Motor Drive Using Flyback Micro Inverter

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Abstract — The project aims to drive a three phase induction motor and the power fed from single solar panel. The motor will drive without usage of battery. Here the maximum power extracted from a solar panel with the help of maximum power point tracking techniques. Here incremental conductance method is used which is an accurate and tracking constant and maximum point. The power which is given to flyback micro inverter. The flyback topology, here two cell flyback inverter is used. This inverter boost the voltage with the help of flyback transformer in a maximum limit and then invert it. This inverter is controlled with the help of pulse width modulation control techniques. Simulation result is displayed. The solar panel rating 250W and the motor driven at rated speed.

Index Terms — solar panel, flyback micro inverter, pulse width modulation, maximum power point tracking, incremental conductance, three phase induction motor.

I. INTRODUCTION

Solar is most important renewable energy in our world. It is mostly available and is used in all applications. The main objective of this project is to drive a three phase induction motor the power fed from single solar panel. The solar panel output is DC. Thus the DC which it boost the voltage and invert it using DC-DC converter and DC-AC converter. The above two conversion topology which it combines the system is flyback micro inverter. It acts as more efficient and power extraction which increase by using maximum power point tracking. In this techniques there are many algorithm available, here incremental conductance is used. The three phase induction motor which is to control the speed and it drives more efficient.

Our proposed system consists of solar panel follower by flyback converter, inverter system and three phase induction motor. The system which has input in solar output and the system output is speed of motor. The maximum extraction of power in solar panel, maximum power point tracking is implemented. To accomplish this, incremental conductance technique is used. The DC-DC Flyback converter is used to compare the impedance level between the solar panel and output load for maximum power transfer capability. The flyback converter using a high frequency transformer which it step up the voltage. Thus the voltage which is compared an inverter and is used to get an AC output with variable frequency. Thus the variable voltage and variable frequency that are controlled and given to the load (i.e. motor) which it maintains better efficiency.

II. PROJECT DETAILS

A. SOLAR PANEL

A Photovoltaic cell is a device which the light energy is converted in to electric energy. An array of panels that are arranged in series and/or parallel. The power from the solar panel that depends upon the solar irradiance level, operating voltage and current and panel temperature level. The solar energy is mostly available renewable energy in our world. In this system, the source of power fed from solar panel output and maximum power extracted depends upon the needs from it.

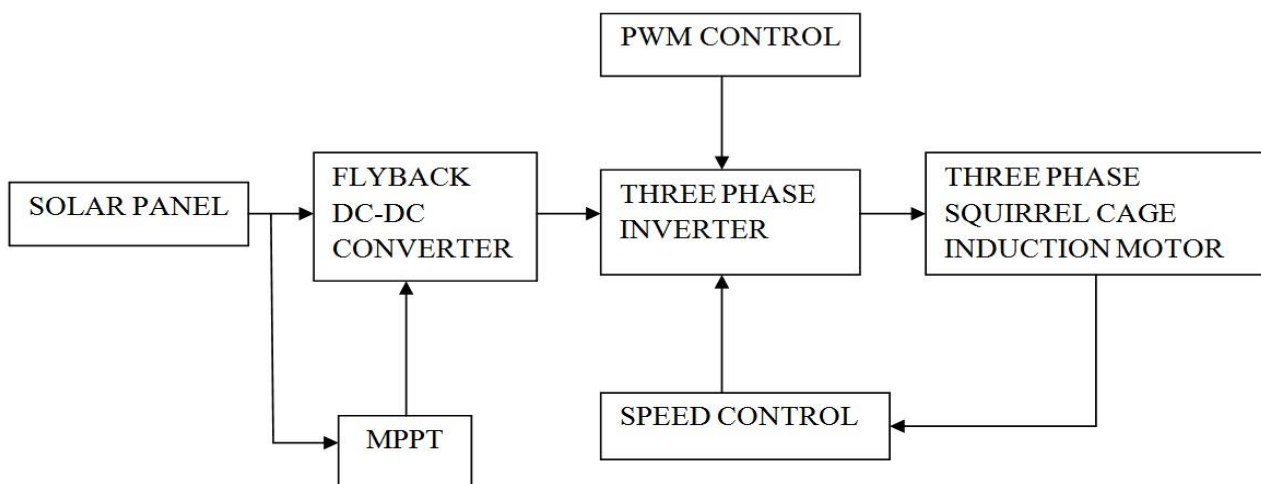


Fig 1. Block diadram of proposed system

B. MAXIMUM POWER POINT TRACKING

A Maximum power point tracking is a device that acts for maximum power point of source keeps is monitoring and operates at a point. There are many algorithms used for

implementing MPPT. The MPPT tries to compare the impedance and the source that demands which the maximum power out of it. The variable impedance which has DC-DC converter maintains a very low losses and then invert it.

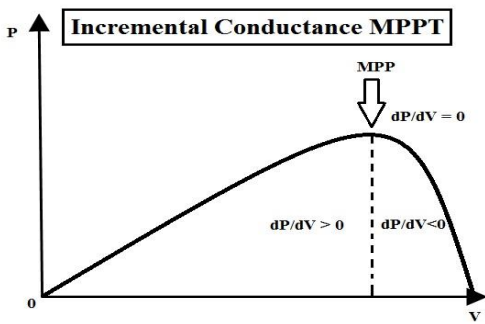


Fig 2. Power Vs voltage Characteristics of incremental conductance MPPT

The solar panel is not operating in maximum power point, with the help of MPPT it tries to force the PV cell to give maximum power at the irradiance.

There are many MPPT techniques available. Here incremental conductance method is used. It maintains the accuracy level and it maintain constant point to extract the maximum power limit.

C. DC-DC CONVERTER

A DC-DC Converter is a switching device that operates one level of DC voltage is converted in to another level of DC voltage. The DC-DC converter consists of a switch, inductor, diode and capacitor, either step up or step down.

Here the converter used in the project is flyback converter. It has a same duty cycle as step up/down except that increased by transformer turns ratio. In these benefits which it matches the solar panel 24V output to nominal voltage output of 230V and usage of minimum converter

In steady state

The input and output relations are

$$V_o/V_{in} = (N_2/N_1) * (D/(1-D))$$

$$I_{in}/I_o = (N_2/N_1) * (D/(1-D))$$

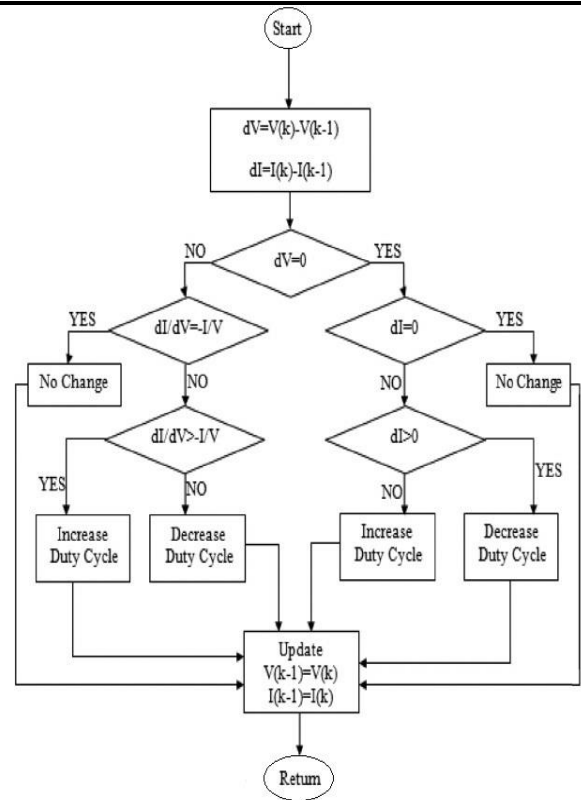


Fig3.Flowchart-of-incremental conductance method

D. DC-AC CONVERTER

The DC-AC converter is an inverter. The device which converts DC voltage in to alternating voltage or current at certain frequency. The frequency depends upon the switching of the MOSFET. The two types of inverter are i) single phase inverter ii) three phase inverter. The inverter quality depends upon the total harmonic distortion (THD) and its efficiency. The inverter switching techniques are PWM pulse given to the switches. PWM techniques is created by comparing of reference and carrier signal. The two main parameter are amplitude modulation and frequency modulation.

The amplitude modulation

$$M_a = V_r / V_c$$

The frequency modulation

$$M_f = V_c / V_r$$

If need to change the amplitude of output voltage, then adjust amplitude modulation. If need to change the frequency, then adjust frequency modulation limits.

E. INDUCTION MOTOR

An induction motor which consists of stator and rotor. This motor is rugged construction and minimal cost. It is self starting machine and easy to maintain. The supply is given to stator which it results an electromagnetic field is induced. The field winding induces the rotor which it produces another field in the rotor, it causes to spin.

When a load is applied to the motor the slip between these two fields. The synchronous speed controlled by adjusting the frequency of stator voltage.

III. RESULTS

The proposed circuit were done in matlab simulink. The simulation presented each component and details are mentioned below specification table.

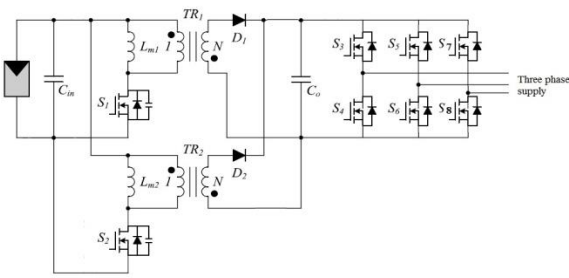


Fig 4. Circuit diagram of three phase flyback micro inverter

The flyback micro inverter circuit diagram is shown below the figure 4. It consists of decoupling capacitor and the flyback transformer and the output is DC which it converts DC-AC with the help of three phase inverter and it connects the three phase supply output to three phase induction motor. The induction motor runs the speed which it control the PI controller. The inverter needs the pulse which is given from PWM control. The PWM inverter output is shown below the figure

TABLE1. Flyback inverter specifications

| Design Parameter | Specification |
|-----------------------------|---------------|
| PV model and maximum power | BP365, 65 W |
| Input voltage | 24 V |
| Switching frequency | 50 kHz |
| Number of interleaved cells | 3 |
| output voltage | 230 V |

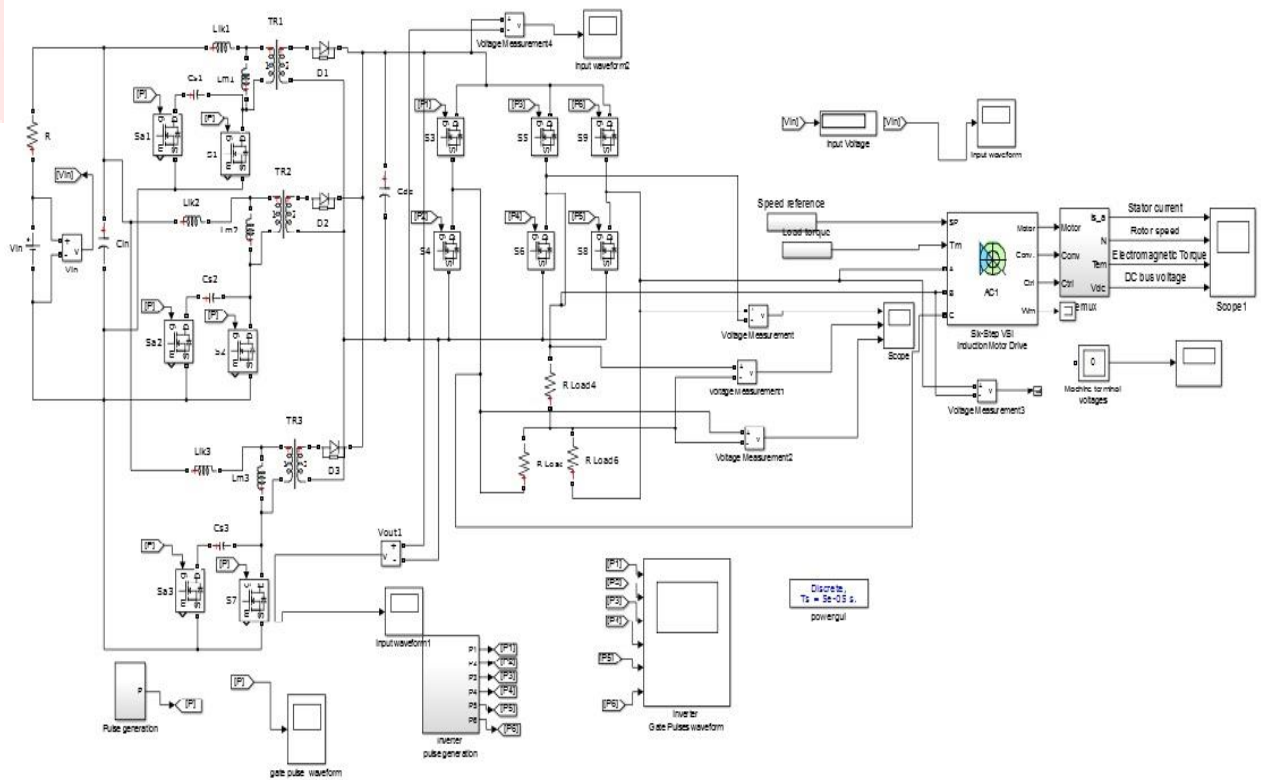


Fig.5 simulation diagram of proposed system

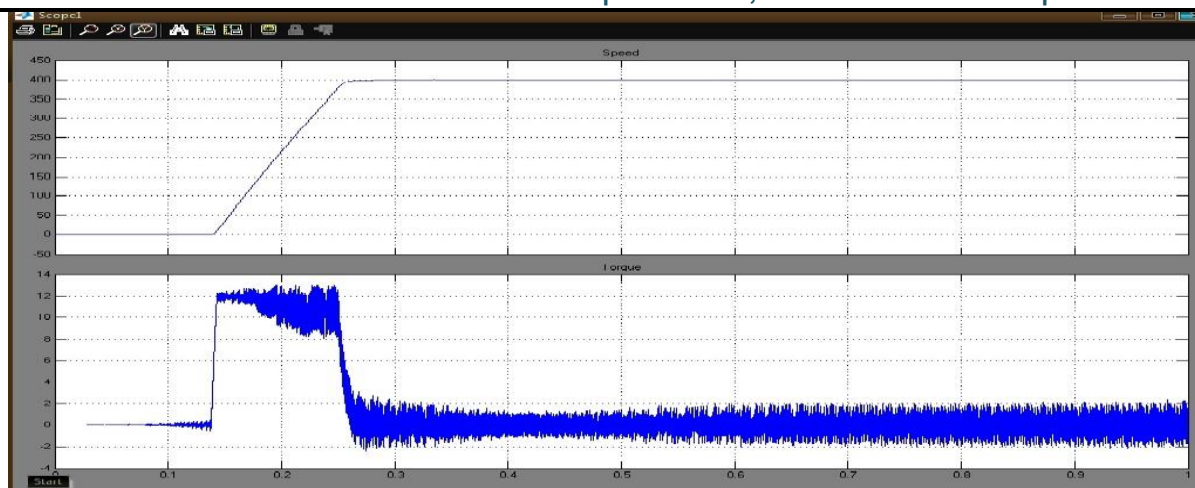


Fig.7 Torque-Speed Characteristics

IV. CONCLUSION

In this simulation, we have driven the induction motor by solar panel. Using incremental conductance MPPT technique is used to extract maximum power from solar panel by using flyback DC-DC converter. The flyback converter is an excellent interface between the panel and load. In these flyback converter we introduces snubber circuit which it reduces the peak over voltages and to give better efficiency. In a bridge inverter we use PWM control techniques and to control the speed of motor by maintaining voltage and frequency ratio as constant. The next stage is to simulate the closed loop control of three phase induction motor drive with the help of solar flyback micro inverter with automatic adjustable speed drives.

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