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Solar Powered BLDC Motor Driven Water Pump Using High Gain Landsman Converter

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ABSTRACT: In order to optimize the solar photovoltaic power using a maximum power point tracking technique, a DC-DC conversion stage is usually required in solar PV fed various applications like water pumping, vehicles etc… which is driven by a BLDC motor. This power conversion stage results in an increased cost, size, complexity and reduced efficiency. The DC-DC conversion stage is eliminated by a BLDC motor-pump fed by a single stage solar PV energy conversion system. For the BLDC motor control, a simple control technique for operating the solar PV array at its peak power using a common voltage source inverter is proposed. The BLDC motor phase current sensors are eliminated by the proposed control. The speed control of motor-pump is not associated with any supplementary control. Fuzzy logic based MPPT algorithm is used to track the power from PV panel. The optimum power of solar PV array controls the speed. The suitability of proposed system is manifested through its performance evaluation using DSPIC30F2010 controller.

KEYWORDS: PMBLDC motor, DSPIC30F2010 controller, PV Supply, Water Pump, BLDC motor.

I. INTRODUCTION

A drive is a combination of electronic device that tackle and controls the electrical energy sent to the motor. The drive indirectly controls the motor's speed and torque by feeding electricity into motor in varying power and at varying frequencies. The speed of rotation of an electrical machine can be controlled precisely by implementing the concept of drive. The main advantage is that with the help of drive, the motion control is easily optimized. In another words, the systems which control or manage the motion of the electrical machines are known as electrical drives. Large number of industries and domestic applications like factories, transportation systems, textile mills, fans, pumps, motors, robots etc., uses this drive system. For diesel or petrol engines, gas or steam turbines, hydraulic motors and electric motors drives are employed as prime movers. In this paper the drive system is used to control the speed of the brushless DC motor.

II. OBJECTIVE

The main objective of this paper is to improve the performance of the BLDC drive by attending more precise speed tracking and smooth torque response by implementing a direct torque scheme.
The overall objectives to be achieved are

1. To design the Landsman converter model for BLDC drive and it's solar oriented applications and closed loop operation of drive system.
2. Analysis and implementation of MPPT control in steady state and transient condition (step change in load and speed) using Simulink environment.
3. To compare the speed response of the PI and/or fuzzy controller.

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III. LITERATURE SURVEY

The concept of applying Direct Torque Control using Space Vector Modulation is studied. It explains the effect of torque ripples and its consequences. The application of the SVM-DTC considerably reduces the torque ripples in the induction motor. The high switching losses and large spikes on the phase voltage results due to the usage of zero vectors along with the active vectors states of the SVM are discussed [1]. So the proposed project uses the space vector modulation technique to minimize the torque ripples. To reduce the switching losses only six active states of the modulation techniques are used [2].

Direct Torque Control of brushless Dc motor having non sinusoidal back emf is studied.[3] Space vector modulation technique is used to generate the quasi sine wave current, by selecting the proper voltage vectors from the pre-defined switching table, which results in fast torque response as compared to the conventional scheme using six steps PWM technique. The six active vectors are used without the two zero vectors in order to reduce the switching losses [4]. The appropriate adjustment of the duty ratio of the active vector selected from the switching table, the torque ripple can be reduced. The stator flux linkage is kept constant by selecting proper voltage vector from the look-up table, so the flux control in the constant torque region is ignored in this paper [5]. The Space vector modulation technique with six active vectors is studied and applied in the proposed project work.

The information will send in the form of SMS to the user on request. Wireless Sensor Based Remote Monitoring System for Agriculture Using ZigBee and GPS, [6] used to realize the GPRS technology, wireless technology the temperature and humidity monitoring system is possible and to maintain low cost investment and low power consumption. Solar E-Bot for Agriculture, [7] in authors have concentrated to provide the power supply through the solar panel for the purpose of alternative source and performance of the robot in an efficient manner with green energy.

IV. PROPOSED SYSTEM MODEL

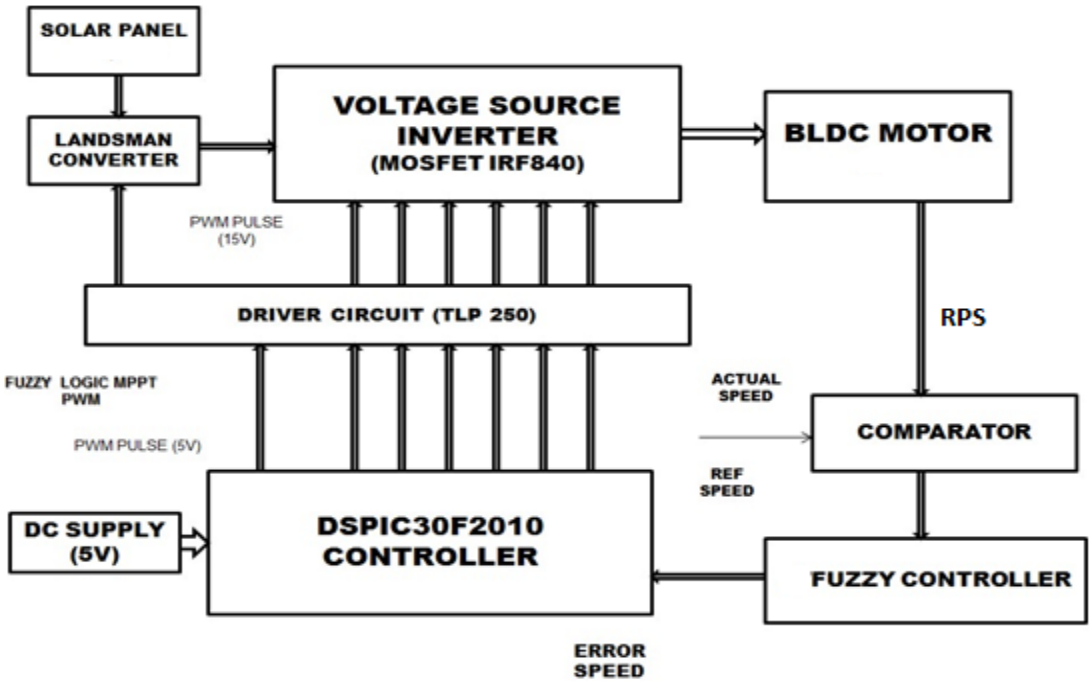

Fig 4.1 FLC Landsman converter fed BLDC Block Diagram

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The inverter is fed with the dc supply through the landsman converter network. The output of the voltage source inverter is given to the BLDC motor. The three phases to two phase conversions are carried out in the transformation block. The torque estimator utilizes the necessary d and q axis current, voltage and the necessary parameters to estimate the actual torque value. The speed error is given as the input to the fuzzy controller to generate the reference torque value. The rotor position is obtained through the back emf sensing method. The direct axis current reference and actual value are compared to obtain the flux error. The flux error, torque error and the rotor position are given as the control signals to the PWM generate to generate the gating pulses for the inverter. The figure 4.1 shows the block diagram of the fuzzy logic controlled Landsman converter fed DTC-PMBLDC motor.

The permanent magnet brushless DC motor is fed by the AC source through the electronic commutator. A LANDSMAN converter is coupled between the DC supply and the inverter to boost up the supply thereby increasing the torque magnitude by reducing the ripples. The direct torque control method is used to control the speed of the motor. The torque error, flux error and the rotor position are the three controlling signals used to generate the gating signals for the inverter. The motor three phase voltages and currents are transformed to the two phase quantities in the synchronously rotating frame using the park and Clarke transformations.

The transformed voltage and current values are used to find out the flux and rotor position values. These values are used to calculate the actual torque value. The reference torque value is obtained from the speed controller and its value is limited in the hysteresis comparator. The flux error is calculated by comparing the reference and the actual value of the direct axis current. The theta (i.e. rotor angle) is calculated and acts as the controlling signal for the inverter. The Fuzzy logic controller is used to control the speed of the PM-BLDC motor. The speed error and the change in speed error are given as the input to the fuzzy logic block. Based on the fuzzy rules the reference torque value is generated. The torque, flux errors and the theta values are used to select the frequency and voltage magnitude of the motor supply and hence controlling the speed of the motor.

V. RESULTS AND DISCUSSIONS

Figure5.1: Hardware Module

the solar panel will provide the adequate power to the circuits and by using this power the LANDSMAN converter and the inverter circuits and can be operated to control the BLDC motor. Here the inverter can be operated 120^0 mode of conduction. The solar will designed with MPPT algorithm to give the maximum power at all the conditions. The hardware kit having a BLDC motor with Hall Effect sensor to control the speed of BLDC motor depending of our requirements. The speed adjustment can also possible in the BLDC motor and reset switch also provided.

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VI. CONCLUSION

A fuzzy logic controller (FLC) has been employed for the speed control of PM BLDC motor drive and analysis of results of the performance of a fuzzy controller and SPWM is presented. Effectiveness of the system is established by performance prediction over a wide range of operating conditions. A performance comparison between the fuzzy logic controller and the conventional PI controller has been carried out by superiority of the fuzzy logic controller. The fuzzy logic controller implementation significantly reduces the manual tuning time of the classical controller. The LANDSMAN converter network has damped the torque ripples in the BLDC motor as well as this will track the MPPT from the given solar panel.

The performance of the PMBLDC motor drive with reference to PI controller, FLC controller and experimental verified with conventional PI controller from result the performance of PMBLDC Drive is improved by the fuzzy logic speed controller.

REFERENCES

1. Bangcheng Han,Haitao Li and Jiancheng Fang, Torque Ripple Reduction in BLDC Torque Motor With Nonideal Back EMF‖ IEEE Transactions on Power Electronics, Vol. 27, No. 11, November 2012.
2. Afjei.E, Anvari.B and A.Siadatan, Design and Simulation of LANDSMAN converter for Brushless DC Motor Drive‖ Specialty Journal of Electronic and Computer Science 2015, Vol, 1 (1): 30-34.
3. Hamid A. Toliyatand SalihBaris Ozturk, Direct Torque and Indirect Flux Control of Brushless DC Motor IEEE/Asme Transactions on Mechatronics, Vol. 16, No. 2, April 2011.
4. Angelo Tani ,DomenicoCasadei, Francesco Profumoand Giovanni Serra ―FOC and DTC: Two Viable Schemes for Induction Motors Torque Control‖ IEEE Transactions on Power Electronics, Vol. 17, No. 5, September 2002.
5. David Howe, Yong Liu and Z. Q. Zhu, Commutation-Torque-Ripple Minimization inDirect-Torque-Controlled PM Brushless DC Drives‖ IEEE Transactions on Industry Applications, Vol. 43, No. 4, July/August 2007.
6. SoumahYaya and Wang Honghua‖Research on reduction of commutation torque ripple in brushless dc motor drives based on fuzzy logic control‖ 2009 International Conference on Computational Intelligence and Security.
7. Ick Choy ,Ji-Yoon Yoo, Joong-Ho Song, and Kyo – BeumLee,Torque Ripple Reduction in DTC of Induction Motor Driven by Three-Level InverterWith Low Switching Frequency‖ IEEE Transactions on Power Electronics, Vol. 17, No. 2, March 2002.