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REVIEW ON WATER PUMPING SYSTEM BY USING SOLAR POWERED BRUSHLESS DC MOTOR

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Abstract

A DC-DC bucket-boost converter is recommended for a solar photovoltaic (SPV) water pumping system using a permanent magnet brushless DC motor (BLDC). In order to design a BB converter with suitable voltage control, the DC-DC boom and buckle converter flow in such a way that maximum power point tracking (MPPT) tracking objectives and soft start of the BLDC motor are achieved. The BB converter shows the advantages of boom and buckle converters and comes up interestingly as a solution to the problems of these converters in SPV applications. Good use of a switch, high efficiency, non-inverse output voltage and low voltage in the power apparatus are features of the BB converter. This paper discusses initial, dynamic and stable state performance under various atmospheric conditions and examines the efficiency of a BLDC motor with a proposed BB converter for SPV-based water pumping. These results can help design different types of converters in the future and will be very helpful for researchers and technology development.

1. INTRODUCTION

In the modern age, there is more energy than production, leading to energy disruption. Physical difficulties have some limitations, such as improving the use of unrestricted energy to solve desirable energy problems. Recently, energy produced from clean, efficient sources in the environment has become one of the most important challenges for engineers and scientists [6]. There has been a much-needed increase in the use of renewable energy as well as in conventional systems to meet human energy needs, and the use of solar energy is a form of clean energy, cheaper from pollution and more economical. [9]. The photovoltaic solar system immediately converts solar energy into electrical energy, and the most efficient algorithm is used to upgrade the solar system to improve the characteristics of solar PV cells. The requirements for MPPT are: easy tracking, low cost, fast mode when conditions and low pump power supply change. The traditional method is simple and inexpensive, with no advanced tracking performance, such as climbing, P&O, and using an ever-increasing algorithm to track the maximum area of the solar system [3]. PV can be used which can work for many purposes.

- Street lightening
- Domestic purpose
- Industries
- Robustness
- low cost
- availability in local markets
- low maintenance
- Potential to operate even in the hazardous condition.

In the excitation system, catalytic motors are usually preferred, but PV-based applications are not suitable for low voltage, which creates problems with the system. High-current motors (BLDCs) have high performance, high reliability, strong power, driving characteristics, as well as good speed [8 - 9]. It clearly competes with engine production, primarily in SPV pumps where price, performance, simplicity, density and driving characteristics are the key factors. In addition, the installation and reliability of the components lead to motor and pump technology as well as additional functions.In general, the motor sensor is now used to control the speed of the BLDC instead of controlling the speed of the motor at the DC voltage of the voltage control, reducing the loss compared to controlling the current sensor.

1. PROBLEM STATEMENT

In recent years, PV based applications have been used almost instantly, one application being the pumping system and for the other it is usually an adapter instead of price, convenience and availability but some drawbacks and drawbacks. useless for SPV water pumping systems, as the risk of overheating if the voltage is too low and requires complex control. To this end, the BLDC motor is still available.To control the speed of a BLDC motor, the current sensor is used which often interrupts the circuit and system with high frequency fluctuations as the VSI operates on a constant switch. This new system works repeatedly as well as speeds with a DC voltage transformer.

2. LITERATURE REVIEW

The paper is given by author Bhim Singh and Rajan Kumar titled as Simple brushless DC motor drive for solar photovoltaic array fed water pumping system. This paper presented that speed is controlled through Variable DC –link of VSI. And VSI is achieved by operating Voltage source inverter at fundamental frequency switching. And also give idea for dynamic and steady state of system under rapid variation in atmospheric condition.

The paper is given by author Mei Shan Ngan, Chee Wei Tan titled as A Study of Maximum Power Point Tracking Algorithms for Stand-alone Photovoltaic Systems presented in this paper gives idea Photovoltaic (PV) energy is one of the renewable energies that attracts attention of researchers in the recent decades. Since the conversion efficiency of PV arrays is very low, it requires maximum power point tracking (MPPT) control techniques to extract the maximum available power from PV arrays. The technique to achieve maximum power is P and O Algorithm, Incremental conductance, fuzzy logic controller. Among all incremental conductance's MPPT gives good results under rapidly changing environmental condition. The incremental conductance algorithm is able to achieve lower oscillation around MPP then P and O.

The paper is given by author A. Terki , A. Moussi, A. Betka, N. Terki titled as An improved efficiency of fuzzy logic control of PMBLDC for PV pumping system. This paper presents an analysis by which the dynamic performances of a permanent magnet brushless DC (PMBLDC) motor are controlled through a hysteresis current loop. And also gives idea regarding conventional system in which BLDC motor control is done by using classical PI controller its modeling and simulation reference.

The paper is given by author Rajan Kumar, Bhim Singh, Ambrish Chandra and Kamal Al-Haddad titled as Solar PV Array Fed Water Pumping Using BLDC Motor Drive with Boost-Buck Converter. This paper deals with the starting, dynamic and steady state performances under varying atmospheric conditions and examines the effectiveness of the BLDC motor with the proposed BB converter for SPV based water pumping. This paper also helps for calculating parameters of new scheme for solar PV array and design for converter configuration.

The paper is given by author Habbati Bellia, Ramdani Youcef, Moulay Fatima titled as A detailed modeling of photovoltaic module using MATLAB presented as the PV module is the interface which converts light into electricity. Modeling this device necessarily requires taking weather data (irradiance and temperature) as input variables. The output can be current, voltage; power as and also detailed modeling of the effect of irradiance and temperature on the parameters of the PV module and elaborates mathematical equation for modeling solar PV array.

The paper is given by author Pramod Pal, TM Shubhum and Dr. Amit Ojha titled as Simulation of Brushless DC Motor for Performance Analysis using MATLAB/SIMULINK Environment presented as Brushless DC Motor is widely used for many industrial applications because of their high efficiency, high torque and low volume. This paper presents the model construction of a brushless DC motor via MATLAB/SIMULINK so that one can evaluate the performance of the BLDC motor control with PWM Control scheme. In the presented model the speed is regulated by PI Controller. The proposed method offers suppress torque oscillation.

The paper is given by author S.G. Malla, C.N. Bhende and S. Mishra titled as Photovoltaic based Water Pumping System presented as a stand-alone Photovoltaic (PV) systems is presented for water pumping. Solar PV water pumping systems are used for irrigation and drinking water. PV Based pumping systems without battery can provide a cost effective use of solar energy. For the purpose of improving efficiency of the system perturb and observe (P&O) algorithm based Maximum Power Point Tracker (MPPT) is connected to this system.

The paper is given by author M.Archana, Mrs. J. Anitha Thulasi, Dr. M. Belsam Jeba Ananth titled as An Efficient Solar power based Four Quadrant Operation of BLDC Motor presented as current controller block for generation of reference current of BLDC motor and also gives idea of BLDC motor control block.

SYSTEM CONFIGURATION

The BLDC motor supports a BB converter which is connected to a water pump. The SPV discovery leads to a VSI-connected BB converter that provides BLDC motor pump power. Using the MPPT calculator, the MPP SPV exposure monitors the operation of the IGBT (dual pole isolated side gear) on the reformer. Additional voltage control is provided with an input transformer that produces an adapter for IGBT buck conversion. The built-in BLDC motor provides a modified Hall of Fame signal to create a flexible switch for the VSI with the electronic delivery of the BLDC motor. The design and operation rules for each part of this service are shown in the additional section Community-verified icon

3. WORKING PRINCIPLE OF PROPOSED BB CONVERTER

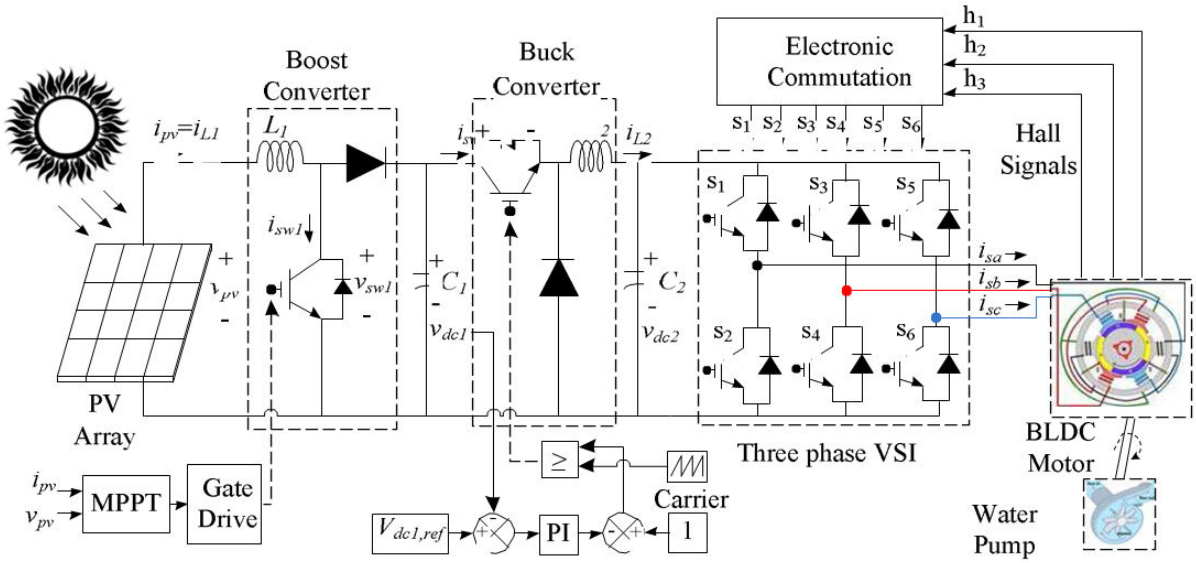

Figure 1: Configuration of the SPV array-BB converter fed BLDC motor driven water pumping system

4. DESIGN OF THE SYSTEM

A 3.2. The various installation stages shown in the figure, such as the SPV matrix, the catalyst, and the water pump, are designed to achieve good satisfaction with changes in solar systems at all times. The thresholds for the three approaches are almost identical to project force design, transition structure, addition of MPPT behavior, and substitution methods. The system configuration is similar to the inverter software configuration configuration. The engine is rated the same for the catalytic converter and the BLDC engine, but the speed control technology is different for different systems.

5. MAXIMUM POWER POINT TRACKING METHOD

The MPPT proficiency is generally used to amend maximum benefits that is maximum efficiency in solar PV planted application. Incremental conductance MPPT controller is used which gives smooth and fast tracking performance under any atmospheric condition. This MPPT gives better performance than P and o algorithm. In generally, main purpose of algorithm is to look towards the appropriate duty cycle in which incremental conductance becoming instantaneous conductance due to that PV system is always operated around MPP. ΔD is incremental size which helps to determine how fast MPP is going to tracked , grater size ΔD, fast tracking will be achieve. The major benefits of incremental conductance are that it can generate superior results beneath quickly changing environment condition. MPPT is tracked via evaluating existing conductance with next incremental conductance. From incremental conductance flowchart [8], current and voltage are output of solar PV array at any time. The duty cycle of boost converter play very important role in order to gets maximum benefits from solar PV array. When solar PV voltage become constant after particular point, output current is going to increases, then duty ratio is also improved. If current declines then duty ratio falls.

6. BLDC MOTOR

Brushless Direct Current (BLDC) motors are one of the motor types rapidly gaining popularity. BLDC motors are used in industries such as Appliances, Automotive, Aerospace, Consumer, Medical, Industrial Automation Equipment and Instrumentation. As the name implies, BLDC motors do not use brushes for commutation; instead, they are electronically commutated. BLDC motors have many advantages over brushed DC motors and induction motors. A few of these are:

- High dynamic response
- High efficiency
- Long operating life
- Noiseless operation

- Higher speed ranges
- Better speed versus torque characteristics

A brushless DC motor (BLDC) is a synchronous electric motor that from a modeling perspective looks exactly like a DC motor , having a linear relationship between current and torque, voltage and rpm. It is an electronically controlled commutation system, instead of a mechanical commutation system (i.e. brushes).We use rotor of permanent magnet because of the natural characteristic of the permanent magnets, the magnetic field in the air gap of the motor is constant. The maximum speed of the motor is limited by the supply voltage from its power source. It can also run from battery.

7. CONCLUSION

The starting, dynamic and steady-state behaviors of the new SPV array- based buck–boost converter fed BLDC motor have been validated for water pumping. The proposed system has been designed, modeled and simulated in MATLAB/Simulink Environment. The boost converter has offered an unbounded region for MPPT. The fundamental frequency switching of VSI, the absolute elimination of current and voltage sensing elements, and the speed control without any additional control scheme or circuit are the significant features which have contributed to develop a simple, cost-effective and optimized efficiency system for water pumping without scarifying its performances.

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