AN ADJUSTABLE SPEED CONTROL WITH SEPIC CONVERTER FED BLDC MOTOR DRIVE FOR AIR CONDITIONER

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ABSTRACT

The main aim of this project displays a Sepic converter-fed brushless DC (BLDC) motor drive utilizing inverter technology for a ventilating framework. Inverter technology is the most recent movement of innovation for the ideal speed control of engines utilized as a part of compressors of aeration and cooling systems. This innovation differs the speed of the compressor engine by changing the yield voltage of the Sepic converter nourishing the BLDC engine as opposed to only turning on and turning off. Furthermore this drive uses a bridgeless design of sepic converter working in discontinuous inductor current mode (DICM) for the power calculate remedy/change at the AC mains for an extensive variety of speed control. Bridgeless design wipes out the requirement for front end diode connect rectifiers (DBR). This diminishes conduction misfortunes and additionally the quantity of semiconductor gadgets utilized.

Keywords: - *Inverter technology; Sepic converter; DICM; DBR;*

1. INTRODUCTION

In this project, the front end bridgeless sepic DC-DC converter maintains the DC link voltage to a set reference value. Switch of the sepic converter is to be operated at high switching frequency for effective control. A sensor less approach is used to detect the rotor position for electronic commutation. A blind startup is used for starting the BLDC motor. A high frequency MOSFET of suitable rating is used in the front end converter for its high frequency operation whereas an IGBT's (Insulated Gate Bipolar Transistor) are used in the VSI for low frequency.

The use of the brushless direct current (BLDC) motor is becoming very common due to features of high efficiency, high flux density per unit volume, low maintenance requirements, and low electromagnetic-interference

problems. These BLDC motors are not limited to household applications, but these are suitable for other applications such as medical equipment, transportation, HVAC, motion control, and many industrial tools.

Brushless DC electric motor (BLDC motors, BL motors) also known as electronically commutated motors (ECMs, EC motors) are synchronous motors powered by DC electricity via an inverter/switching power supply which produces an AC/bi-directional electric current to drive each phase of the motor via a closed loop controller. The controller times commutation (hence rpm) and creates current waveforms (hence torque). In this context alternating current does not imply but does include a sinusoidal waveform, with minimal restriction on waveform; it must be periodic, and its frequency will determine motor rpm, and the waveform does effect how smooth the generated torque is as well as the motors efficiency at transforming electrical to mechanical energy. In a well design PMSM the air gap magnetic flux is spatial sinusoidal and the phase commutation currents are sinusoidal, ninety degrees out of phase.

2. RELATED WORK

1) X. Huang, A. Goodman, C. Gerada, Y. Fang, and Q. Lu, "A single sided matrix converter drive for a brushless dc motor in aerospace applications," IEEE Trans. Ind. Electron., vol. 59, no. 9, pp. 3542–3552, Sep. 2012.

This paper describes a brushless dc (BLDC) drive with a single sided matrix converter (SSMC) for an electro hydrostatic actuation system in aerospace application. The use of an SSMC with a BLDC motor is novel and is used to achieve operation without a microprocessor. A simple hysteresis current control strategy is implemented to control motor torque. The multiphase SSMC provides high reliability and fault tolerance with the penalty of more power devices. A five-phase SSMC prototype is built. The experiment results are presented to verify the drive performance.

2) Y. Chen, C. Chiu, Y. Jhang, Z. Tang, and R. Liang, "A driver for the single phase brushless dc fan motor with hybrid winding structure," IEEE Trans. Ind. Electron., vol. 60, no. 10, pp. 4369–4375, Oct. 2013.

This paper mainly proposes a novel driver for a single-phase brushless dc fan motor with a hybrid series/parallel winding structure. The winding symbols and directions of the hybrid motor stator structure are defined, and the winding steps for the proposed series/parallel winding are explained. An adequate inverter driving circuit, which is capable to simultaneously obtain the advantages of the hybrid structure, is also discussed. At last, the overall system of this hybrid brushless dc motor with the proposed driving circuit is then implemented to verify the performance of the proposed driver and structure.

3) B. Singh, B. N. Singh, A. Chandra, K. Al-Haddad, A. Pandey, and D. P. Kothari, "A review of single-phase improved power quality ac dc converters," IEEE Trans. Ind. Electron., vol. 50, no. 5, pp. 962–981, Oct. 2003.

Solid-state switch-mode rectification converters have reached a matured level for improving power quality in terms of power-factor correction (PFC), reduced total harmonic distortion at input ac mains and precisely regulated dc

output in buck, boost, buck–boost and multilevel modes with unidirectional and bidirectional power flow. This paper deals with a comprehensive review of improved power quality converters (IPQCs) configurations, control approaches, design features, selection of components, other related considerations, and their suitability and selection for specific applications. It is targeted to provide a wide spectrum on the status of IPQC technology to researchers, designers and application engineers working on switched-mode ac–dc converters. A classified list of more than 450 research publications on the state of art of IPQC is also given for a quick reference.

4) S. Singh and B. Singh, "A voltage-controlled PFC Sepic converter based PMBLDCM drive for air-conditioners," IEEE Trans. Ind. Appl., vol. 48, no. 2, pp. 832–838, Mar./Apr. 2012.

This paper deals with a Sepic dc–dc converter as a single-stage power-factor-correction converter for a permanent magnet (PM) brushless dc motor (PMBLDCM) fed through a diode bridge rectifier from a single-phase ac mains. A three-phase voltage-source inverter is used as an electronic commutator to operate the PMBLDCM driving an air-conditioner compressor. The speed of the compressor is controlled to achieve optimum air-conditioning using a concept of the voltage control at dc link proportional to the desired speed of the PMBLDCM. The stator currents of the PMBLDCM during step change in the reference speed are controlled within the specified limits by an addition of a rate limiter in the reference dc link voltage.

3. EXISTING METHODOLOGY

The bridgeless (BL) buck–boost converter-fed brushless direct current (BLDC) motor drive is used to improve the power Factor Correction. The parameters of the BL buck–boost converter are designed such that it operates in discontinuous inductor current mode (DICM) to achieve an inherent power factor correction at ac mains. The speed control of BLDC motor is achieved by the dc link voltage control of VSI using a BL buck–boost converter. This reduces the switching losses in VSI due to the low frequency operation of VSI for the electronic commutation of the BLDC motor.

4. PROBLEMS IN THE EXISTING SYSTEM

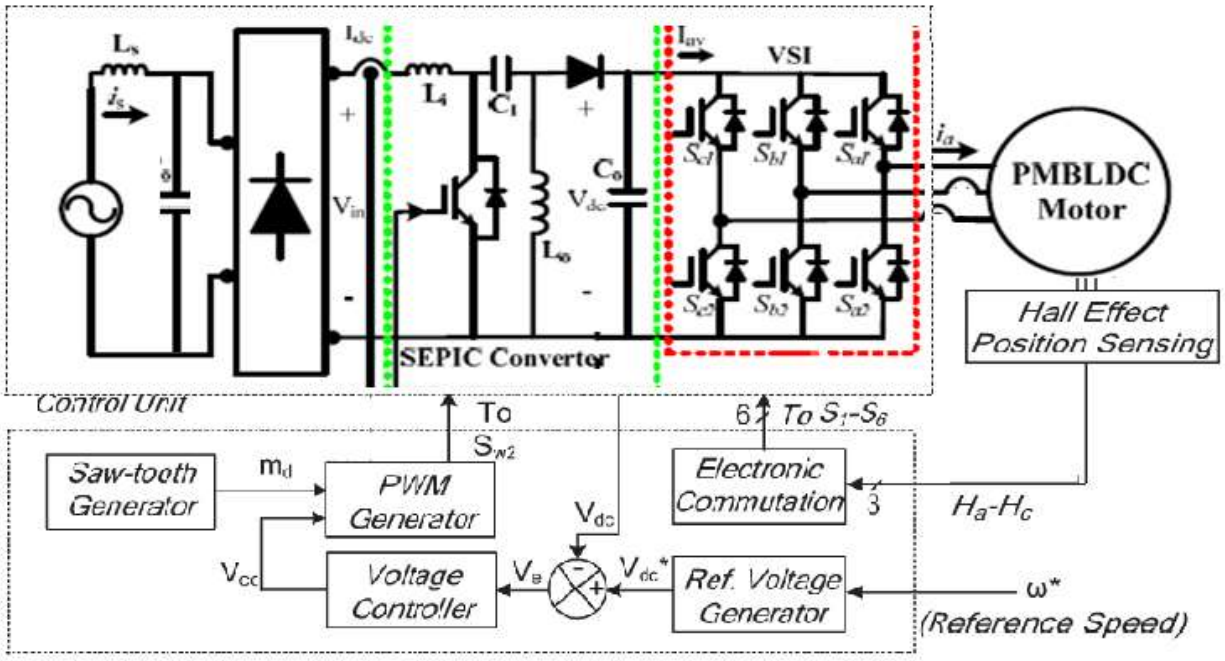
In existing methodology the buck–boost conversion function is operated with polarity reversal and it is operated on low frequency resonant condition**.**

5. PROPOSED WORK

We propose a sepic converter-fed BLDC motor drive with variable dc link voltage of VSI for improved power quality at ac mains with reduced components.The PFC converter has ensured reasonable high power factor close to unity in wide range of the speed as well as input AC voltage. Moreover, performance parameters show an

improved power quality with less torque ripple, smooth speed control of the PMBLDCM drive. The fuzzy logic controller is a robust controller which controls the speed variation for a wide speed reference range.

5.2 CIRCUIT DIAGRAM:

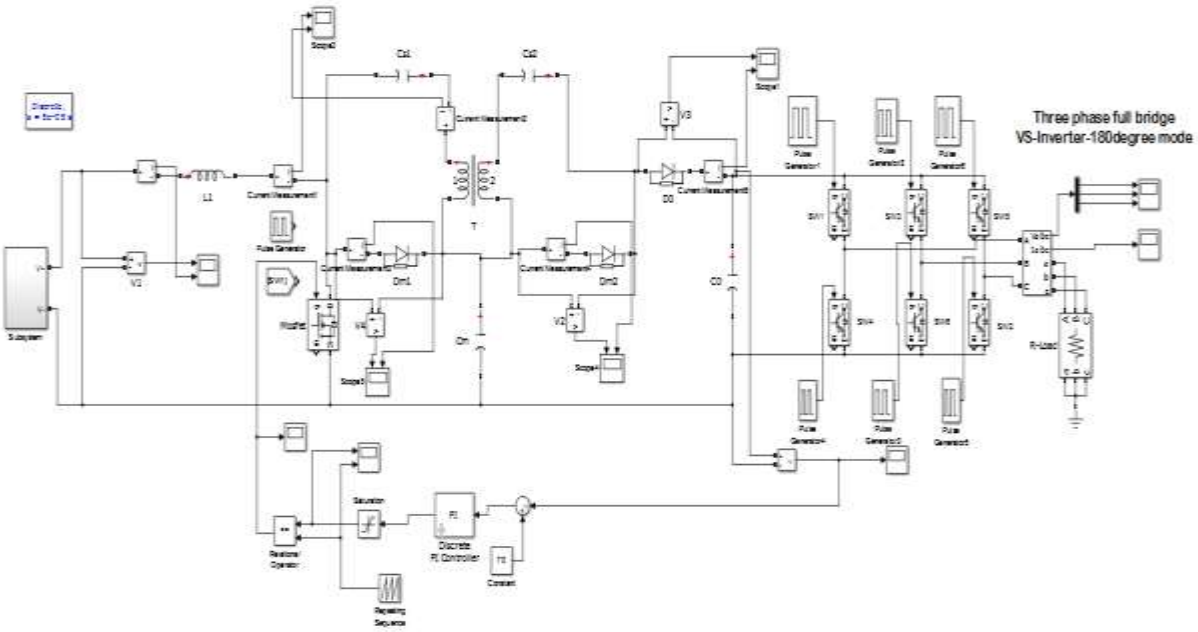


5.2 WORKING:

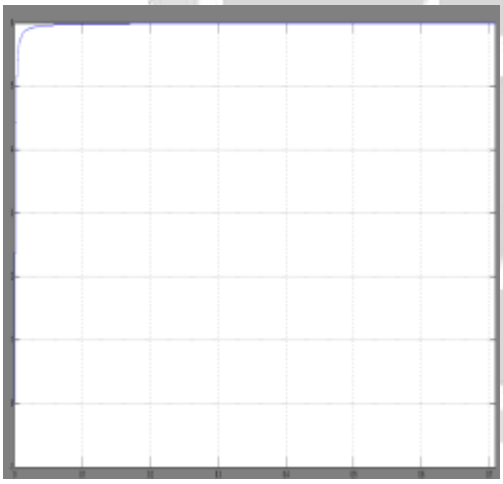
During the positive half cycle of the supply voltage, switch Sw1, inductor Li1, and diodes D1 and Dp are operated to transfer energy to dc link capacitor Cd.

Similarly, for the negative half cycle of the supply voltage, switch Sw2, inductor Li2, and diodes D2 and Dn conducted.

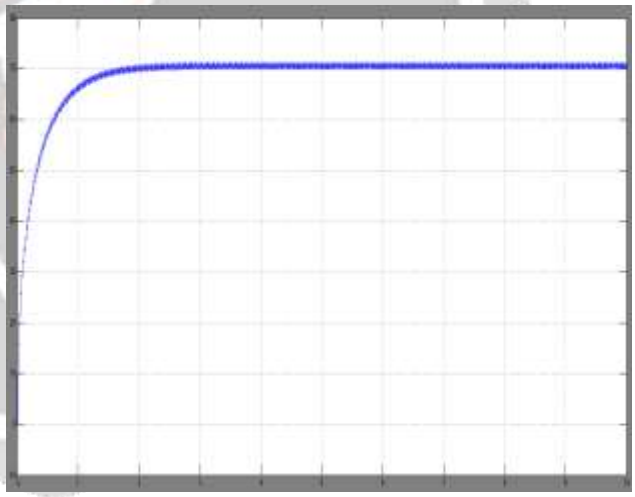
7.SIMULATION AND RESULT



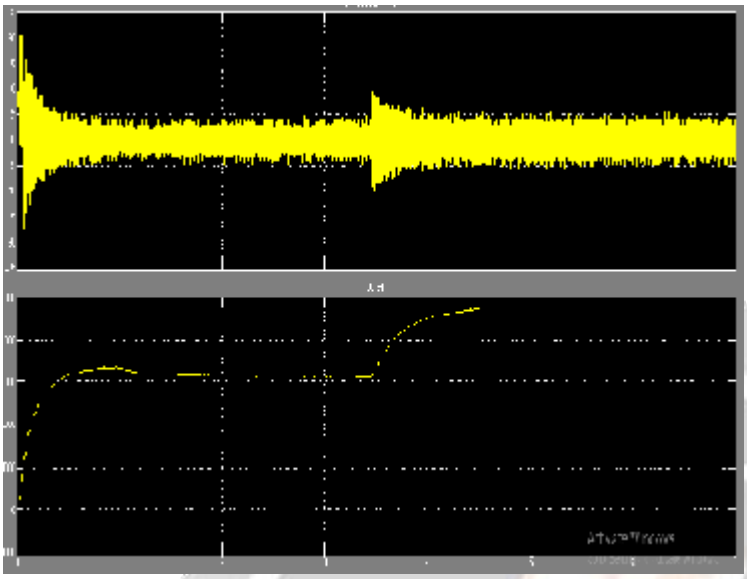
INPUT VOLTAGE



OUTPUT VOLTAGE



SPEED OUTPUT:



6. CONCLUSION

The speed of the motor is continuously taken from the sensor and the speed of the motor is varied comparing the set speed and the actual speed. This gives a perfect closed loop control of the motor. Moreover a sensorless control of BLDC motor is used to eliminate the requirement of hall effect position sensors and making the drive more cost effective.Thus air conditioner performance is effectively improved thereby satisfying the user requirements.

7. FUTURE WORKS:

Our future work focuses on providing very useful interactive user interface and it aims at providing efficient use of Fuzzy PID in real time applications.

8. REFERENCES

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