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Speed & Torque Control of BLDC Motor by using Method of Sliding Movement of Stator Field

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Abstract: The development of electric motors is now growing rapidly. Demands to deliver a reliable and easy to drive in motor control causes Brushless Direct Current (BLDC) motor becomes a potential candidate. A BLDC motor drive is a potential option for an electric drive since it has a high reliability, simple design, and ability to work at high rotation per minute (RPM). This project aims for speed control of BLDC motor using change of position of stator field with respect to rotor in linear motion by sliding action controlled by solenoids and also has a inbuilt closed loop feedback system to adjust the speed accurately as compared to power semiconductor based electronic speed controllers which are costly and injects harmonics in the system.

I. INTRODUCTION

A. BLDC motors are currently widely used in industry, especially in the automotive field. The development of electric vehicles for several decades brought the need for reliable electric motor actuators.
B. The considerations of BLDC motors as actuators electric vehicle because this motor has a high resistance, the simple design and the ability to work at high speed.
C. Old system uses power semiconductors-based bridges which is supplied with PWM signal, from a signal generator and a programed microcontroller.
D. These systems are complex, costly, inefficient and injects harmonics.
E. Mechanically sliding the stator field in a liner motion using a liner motion-based assembly designed for movement of stator within the outrunner rotor.
F. This movement changes the magnetic flux linkages of stator field with respect to rotor which in turn controls speed and torque of BLDC motor.
G. Use of closed loop feedback system taking feedback from laser-based tachometer to sense ongoing revolution per minute of motor and feeds back to microcontroller.
H. The feedback is processed with PID system to adjust the speed precisely to speed demanded by adjusting position of stator field.
I. Solenoids are used to move the stator and lock it in position in linear manner.

II. APPLICATION

A. For latest type of electric vehicles which utilizes BLDC HUB Motor
B. BLDC Motor Special for Outrunners.
C. BLDC Motor with stator size greater than 20050 (200 mm Diameter, 50mm height).
D. Robotics arms in production industry (car, bike, instruments, etc.).

III. HARDWARE

A. 500-1000 W BLDC Motor, 36/48V, 360kV, 10/15A
B. BLDC Motor Starter (Sensor/Sensor less) 500/1000 W, 36/48V
C. Linear Motion Assembly
D. Solenoid 12V, 3A
E. DAC IC
F. Laser Emitter 0.01mW, 3.3V
G. Photo Diode
H. BUCK Converters
I. Microcontroller AT-Mega 2560
J. Circuit BOX & Frame
K. Power Supply Unit

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IV. BLOCK DIAGRAM

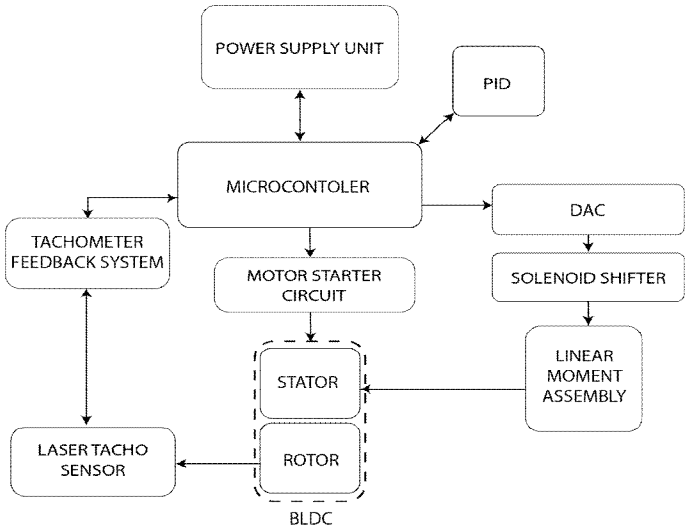

Fig 1- block diagram

A. BLDC types of BLDC

For the speed control, bldc will match to the motor speed and give feedback to the command speed which has given and program. If there any error PID system will send signal to digital to analog converter which will in turn control the position of solenoid shaft connected to the linear moment assembly and hence stator start moving in and out to change the magnetic flux linkage and interchange speed and torque of bldc motor as per the command

B. BLDC Diagram

This the bldc block diagram and project design for our proposed system as onthe left we can see the pictorial representation of our idea how our project look like which shows the front view of bldc motor construction, and on the left side shows the different part of bldc motor including stator core that is placed inside main core, outer side we can see rotor body with some red dash which are highly powered special kind of permanent magnets.

The complete assembly is the rotor which we can see on the outer side hence it is called as outer runner BLDC motor

On next pictorial design of our project side view is present where we can have the side how can green colour shows the solenoid are attached to the stator

V. METHODOLOGY

A. Selection of suitable BLDC Motor with motor starter.
B. Design & Fabrication of Main Circuit.
C. Design & Fabrication of custom motor housing.
D. Design & Fabrication of Stator & Rotor Bracket.
E. Design & Fabrication of Linear Motion Assembly with Solenoid.
F. Design & Fabrication of Mounting Frame.
G. Assembly of BLDC Shaft with Tachometer System.
H. Programming complete system.
I. Complete assembly and the testing of Speed Control of BLDC Stator Position Vary.
J. Rectifying errors if any & finding areas of improvement.

VI. CONCLUSION

A. In our system
B. We are using mechanical sliding the stator field in linear motion
C. This changes the magnetic flux linkage of stator field w.r.to motor which in turn control the speed of bldc.
D. Also we have use the feedback system which gives the accurate speed of the bldc.
E. Hence by using this new method we can control the speed of motor with reliable and in cheap way.

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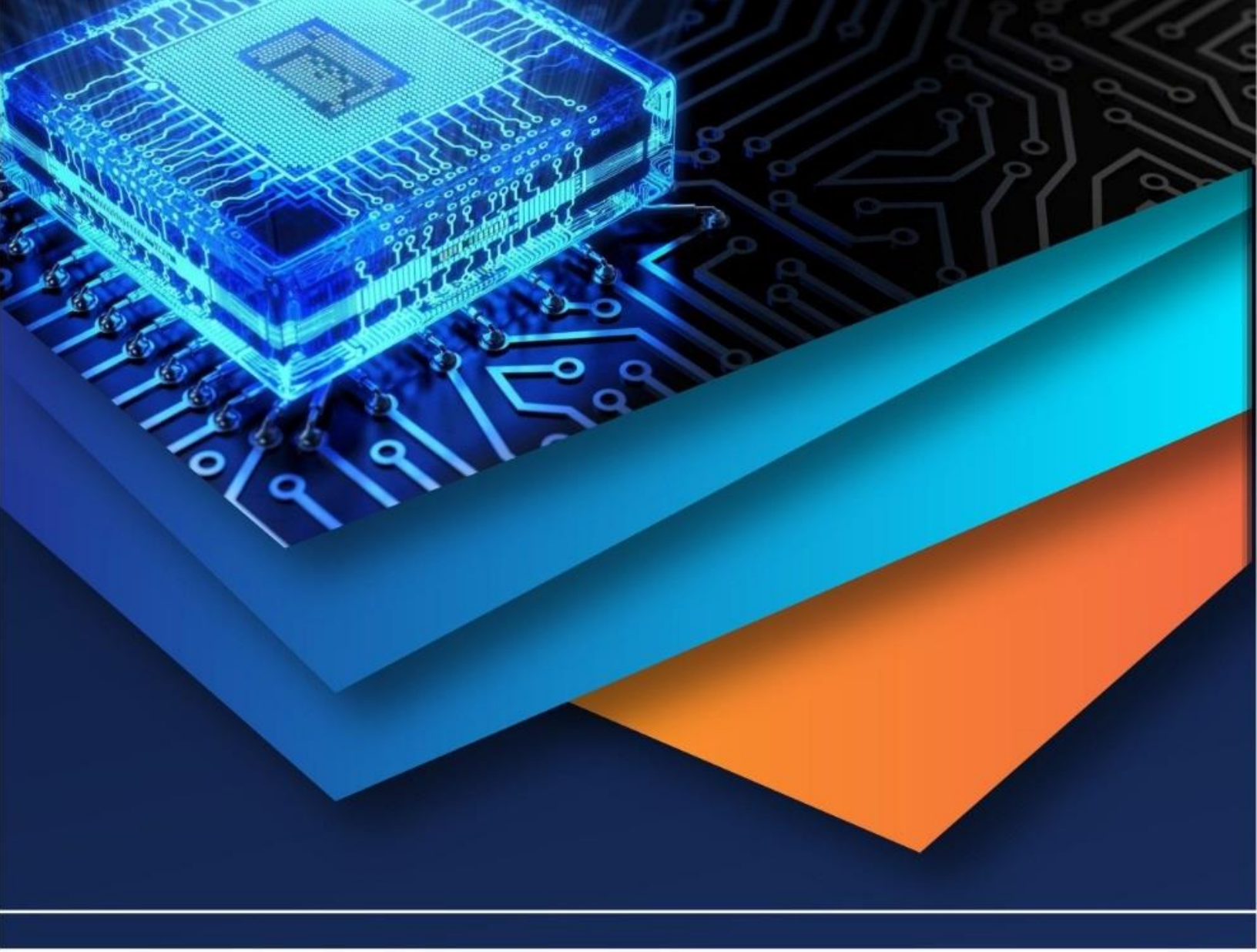

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