

BLDC motor control with Sensored and Sensor less technique

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Abstract - Due to Significant increase in the demand of electric motors, design and manufacturing of high efficiency motors and related variable speed drives has been a major interest now days. Brushless DC (BLDC) motor has many advantages over conventional motors including high torque capability, high speed and perfect position control also. Ac induction motor has sleep problem and consist high switching losses as well as power losses. So hereby we study design and simulation of High voltage BLDC drive. There are many power electronics topologies like Converter Inverter are used in design of High voltage BLDC drive. Sensored and Sensor-less topology used for commutation. BLDC motors and drive plays major role in centrifugation applications. Centrifugation plays major role in dairy industries, oil industries, chemical industries and laboratory equipments. EMI-EMC testing required for better performance.

Keywords - BLDC Motor, Hall sensors, BEMF, Sensor less commutation, Speed, Torque, EMI-EMC

I. INTRODUCTION

The brushless DC motor (BLDC) is becoming increasingly popular in sectors such as Automotive (particularly electric vehicles (EV)), Medical, white goods and Industrial. because it does away with the mechanical commutator used in traditional motors, replacing it with an electronic device that improves the reliability and durability of the Unit. Another advantage of a BLDC motor is that it can be made smaller and lighter than a brush type with the same power output, making the former suitable for applications where space is tight. The downside is that BLDC motors do need electronic management to run. For example, a microcontroller – using input from sensors indicating the position of the rotor – is needed to energize the stator coils at the correct moment. Precise timing allows for accurate high speed and torque control, as well as ensuring the motor runs at peak efficiency. Here we explains the fundamentals of BLDC Motor control operation and describes typical control circuit for the operation of a three-phase unit. also considers some of the integrated modules – that the designer can select to ease the circuit design – which are specifically designed for BLDC motor control. Also we discuss about EMI-EMC and Power factor correction for High voltage BLDC drive.[1][3]

II. BLDC MOTOR CONTROL

A BLDC Motor control has mainly two types, These two types are as per below,

1. Sensor less Commutation Motor Control.
2. Sensored commutation Motor control

There are Many types of BLDC motor available in market, 24 vdc, 48 vdc and 310 vdc, Typically 24 Vdc motor mostly used in laboratory and medical equipment But now days torque capacity needed in some centrifugation technique and Speed Requirement also higher this time. So people have to move toward High voltage BLDC motor and because of that requirement also increase for High voltage Motor Control. Smaller 24 volts motor need special SMPS or buck type power supply to Drive this motor from mains because of that additional product cost increases. While 310 volts higher voltage motor control is now popular for Higher torque with Better speed.

Sensor less Commutation Motor Control.

In Sensor less commutation, Motor control does not depends on Hall sensor Commutation. In this method simply sense the BEMF from motor winding then amplified and applies to Micro-controller or Micro-processor. Speed calculated with the help of BEMF voltage sensing. But with this technique we cannot get accurate speed as well as position control.

Sensored commutation Motor control

In Sensored Commutation, There is Three Hall sensor Mounted in Motor At 120 degree apart. Hall sensor is working on Electro-Magnetic principle. So When Motor rotates then because of its construction Rotor Magnet Passes nearby Hall sensor and because of Hall Effect generates 5 volt pulses. These Pulses Measured with micro controller or Micro processor. We can also find out accurate Speed and Position control with the help of this technique.[10]

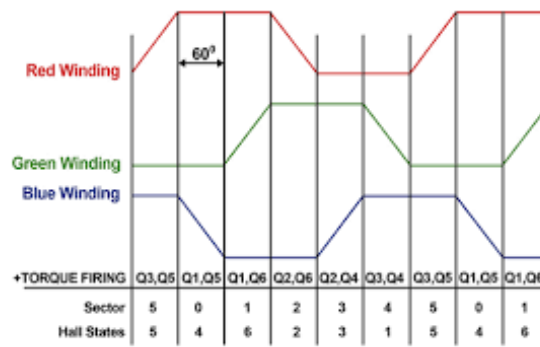


Fig.1 (a)Trapezoidal waveform [10]

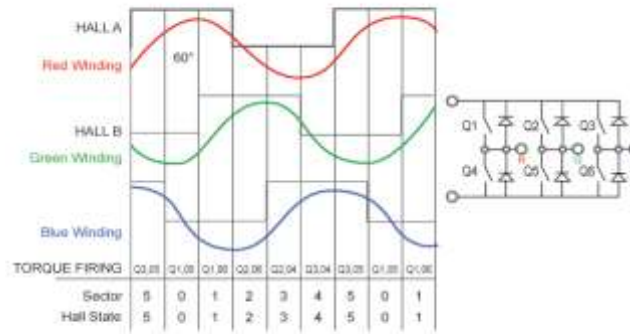


Fig.1. (b) Sinusoidal wave form

III. APPLICATION

There are many Applications where BLDC Motor used. Now days BLDC Motor used for Centrifugation purpose we can add rotor on Motor shaft and generate Centrifugal force inside the liquid. Also Centrifugation needed in Oil industries as Well as Medical and Laboratory equipments industries. BLDC motor also used in Motion control and Position control so it is useful in CNC Machine. Now days BLDC used in Fan control because of its long life than DC and AC Induction Motor. BLDC Motor used in Aeronautical and Space application also. BLDC motor Consist higher speed than AC and Brush DC.[10]

IV. EMC-EMI TESTING

There are many standards for different – different application like medical, industrial and consumer product. So our product is generally used in laboratory for generating centrifugal force to separate particles from liquid. So we need to check EMC according to laboratory product standard. EN61326-1 is EMC standard for laboratory. We need to conduct test like RE, CE, EFT, SURGE, RS, CS, HARMONICS and VOLTAGE DIPS.

V. RESULT

Hall Sensor based motor control is very accurate than Sensorless motor control. Hall sensor give precise position control and accuracy in term of speed and torque. Sensorless motor control works on BEMF sensing instead of Hall sensor. So it's useful to use in Higher speed application. EMI-EMC required for better performance in operation and Electronics environment compatibility.

Parameter	Value
Speed	6500 RPM
Torque	0.5 N*M
Direction	CCW
Power factor correction	0.899
RPM accuracy	+ / - 100 RPM
Conduction Emission	AS PER CISPER 11 Standard
Radiated Emission	AS PER CISPER 11 Standard
EFT	+ / - 2 KV
Surge	+ / - 1 kv Line to Line + / - 2 kv Line to Earth

Table 1 Performance parameter

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