A Study on the Position Signal Compensation Control Technique of Hall Sensor Generated by Uneven Magnetic Flux Density

Jong Suk Lim¹, Dong-Woo Kang², Sol Kim³, Ju Lee⁴

1. Dept. Electrical Engineering, Hanyang University, 04763, Seoul, Korea
2. Korea University, 1095 Dalgubok-dae Ro Dalseo-gu Daegu, 42601, Republic of Korea
3. Yanhan University, 590 Gyoogin-ro Bucheon-si Gyeonggi-do, 14780, Republic of Korea

Mon-Af-Po1.04-17[47]

Background

The BLDC motor is generally used a lot of 120degree energizing method using hall sensor. When the hall sensor is used for control, the energizing period of the BLDC motor is determined by the position signals of the three hall sensors. These hall sensors detect the position of the rotor by attaching three hall sensors to the rotor at intervals of 120 degrees. However, there may be an error in the mounting position of the hall sensor. The incorrect energizing interval is caused by the mounting position error of the hall sensor.

Objectives

- The phenomenon of incorrect energizing interval due to the mounting position error of the hall sensor is analyzed.
- The value of this error is derived as an equation and an algorithm that compensates for the error value is studied.
- The maintenance of accurate energization interval is verified even though Hall sensor has the positional error.

Conclusion

- the phenomenon of incorrect energizing interval due to the mounting position error of the hall sensor is analyzed.
- This inaccurate energizing interval causes an increase in current ripple and noise in controlling the motor.
- we propose a control method to overcome the above problems and verify that the efficiency improvement and the current ripple are reduced by experiments.
- These results are expected to greatly improve the efficiency of BLDC motors, which are widely used in the industry.

Analysis of energization due to position signal of hall sensor

Phenomenon analysis

- Difference in position of Hall sensor for the magnet
- Difference in position of Hall sensor for the magnet
- Difference in position of Hall sensor for the magnet

Algorithm Implementation and Experimental Results

- Energization Angle Control Algorithm
- Hall Signal Compensation Algorithm

Output waveform through experiment

- Terminal voltage: 10V/div
- Phase current: 5A/div
- Mechanical angle
- Compensated hall sensor sector

Presented at the 25th International Conference on Magnet Technology, 2017 Aug. 28 – Sep. 1, Amsterdam, Netherlands; Session: EI-764, Mon-Af-Po1.04

References

- Magnetic flux density becomes smaller as the distance between the magnet and hall sensor increases.
- The position A is positioned far from the magnets, compared to the position B.
- Two different case of hall sensor positions.
- The position A is positioned far from the magnets, compared to the position B. Magnetic flux density becomes smaller as the distance between the magnet and hall sensor increases.