DC Motors

Brushless Commutation

Publication Date: 11/10/2017

Rotalink
Miniature Motors,Transmission and Control

Brushless DC motor - Electronic Commutation

Commutation of a brushless motor can be achieved using either a sensorless method or by utilising internal hall effect sensors. Using hall effect sensors provides a robust commutation scheme which is suitable for running motors across a wide range of speeds providing high torques and good acceleration control. All Rotalink Brushless DC motors are available with hall effect sensors and therefore we generally recommend utilising a sensored control method.

Sensored Block Commutation

The hall effect sensors detect the angular position of the magnetic poles on the rotor; because these sensors are positioned on a 120° offset (electrical angle) they provide six different signal outputs states per electrical revolution (360º electrical angle equates to the motion of one full magnet pole pair, a motor with 2 pole pairs has a 720º electrical angle per motor revolution). The electronic control system is able to interpret the hall feedback to determine which motor phases should be energised to move the motor in either a CW or CCW direction.

The Rotalink datasheet indicates whether the commutation scheme shown results in a CW or CCW motion of the motor shaft.

Sensorless Block Commutation

Due to the lack of sensors required in the motor a sensorless drive is a lower cost approach to brushless motor commutation. However it has major drawbacks relating to undefined start up (the motor may 'cog'), poor low speed operation and reduced acceleration/deceleration rates, all of which make sensorless commutation unsuitable for dynamic operation.

As shown in the sensored commutation diagram at each switching step there is one coil which is not powered. By measuring the induced voltage at this point it is possible to detect when the magnet has rotated to the next switching step. When the induced voltage is at a zero crossing (see ①) 30º of electrical angle has occurred since the last step. The electronics can set a counter running to time the next 30º (based on time taken for 30º since last step change). When the timer finishes the next step is energised and the next motor phase is monitored for induced voltage zero crossing.

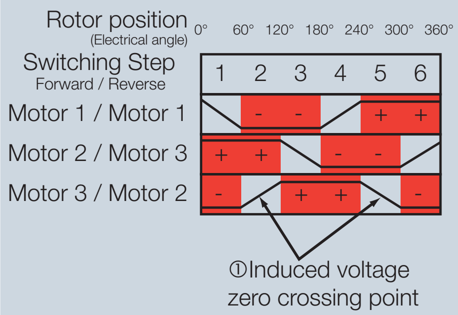
When the motor is stalled, or the speed is low the induced voltage can be too small for the zero crossing to be accurately detected, this results in the poor low speed performance by this method of commutation.

Sensored Commutation

Rotor position (Electrical angle): 0° 60° 120° 180° 240° 300° 360°

Switching Step Forward / Reverse	1	2	3	4	5	6
Hall A / Hall C	1	1	1	0	0	0
Hall B / Hall B	0	0	1	1	1	0
Hall C / Hall A	1	0	0	0	1	1
Motor 1 / Motor 1		-	-		+	+
Motor 2 / Motor 3	+	+		-	-	
Motor 3 / Motor 2	-		+	+		-

Sensorless Commutation



Contact:
www.rotalink.com
info@rotalink.com
T: +44 (0)1460 72000

Rotalink Limited
Cropmead, Crewkerne
Somerset TA18 7HQ, UK

www.rotalink.com