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Rotor position identification of brushless DC-Motors

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A brushless DC-Motor is a system of an adjustable electric drive consisting of an alternating current motor structurally similar to a synchronous machine, a converter and control devices providing switching of the winding circuits of the electric motor depending on the position of the rotor.

Brushed-DC motors use brushes and a commutator that acts as an electromechanical switch to connect the windings in the proper polarity. The mechanical switch can replace with electronic switches in BLDC motors with the polarity-reversal timing controlled by an electronic circuit.

Thus, there are four main elements of brushless DC-Motors:

1) Electromechanical converter (electric machine);

2) The inverter that performs the functions of the switch, connecting and disconnecting the phases of the electric motor from the power according to a certain algorithm;

3) The rotor position sensor;

4) Inverter, processing signals coming from the rotor position sensor.

We will consider the third element of brushless DC-Motor.

Ordinarily, BLDC motors use Hall-effect devices (HFD) to sense rotor position and control the electronic drive of the motor. Based on the physical position of the Hall sensors, there are two types of output: a 60° phase shift and a 120° phase shift.

Combining these three Hall sensor signals can determine the exact communation sequence.

Motor with three phases labeled X, Y, and Z, phase power might follow the pattern XY'-YZ'-ZX'-X'Y-Y'Z-Z'X. The labels X, Y, and Z indicate normal current polarity is applied to those phases while X', Y', and Z' means the current polarity is reversed in that phase. X, Y, and Z are mounted on the stator at 120° intervals, while the three phase windings are in a star formation. For every 60° rotation, one of the

Hall sensors changes its state; it takes six steps to complete a whole electrical cycle. In synchronous mode, the phase current switching updates every 60°.

However, what if one of the received sensor signals does not arrive, or does the received signal have an incorrect value? We consider the case one position semsor failue. We use probablistic approach to recover rotor position signal sensor, based on using previous values of rotor position.