

# Brushed v's Brushless Servo Motors

## **BRUSHED MOTORS**

A DC Brushed Motor (pmdc) has a rotating set of wound wire coils called an armature, which acts as an electromagnet with two poles. A mechanical rotary switch called a commutator reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutator reverses the polarity of the armature electromagnet. During the instant of switching polarity, inertia keeps the classical motor going in the proper direction.

### Brushed Motor Pros

- Two wire control
- Replaceable brushes for extended life
- Low cost of construction
- Simple and inexpensive control
- No controller is required for fixed speeds
- Operates in extreme environments due to lack of electronics

### Brushed Motor Cons

- Periodic brush replacement maintenance is required
- Speed / torque is moderately flat. At higher speeds brush friction increases, causing reduced torque
- Poor heat dissipation due to internal rotor construction
- Higher rotor inertia which limits the dynamic characteristics
- Lower speed range due to mechanical limitations on the brushes
- Brush arcing will generate noise causing EMI

## **BRUSHLESS MOTORS**

A DC Brushless Motor (bldc) uses a permanent magnet rotor, three phases of static driving coils, one or more Hall effect devices to sense the position of the rotor, and the associated drive electronics. The coils are activated, one phase after another, by the drive electronics as cued by the signals from the Hall effect sensors, they act as 3-phase synchronous motors containing their own variable frequency drive electronics.

### BLDC Motor Pros

- Electronic commutation based on Hall position sensors
- Less required maintenance due to absence of brushes
- Speed / Torque – flat, enables operation at all speeds with rated load
- High efficiency, no voltage drop across brushes
- High output power / frame size
- Reduced size due to superior thermal characteristics
- BLDC stator windings are connected to the case resulting in better heat dissipation
- Higher speed range – no mechanical limitation imposed by brushes / commutator
- Low electric noise generation

### BLDC Motor Cons

- Higher cost of construction
- Control is complex and expensive
- Electric Controller is required to keep the motor running. It offers double the price of the motor



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