Report on BLDC motors and ESC

Madan Y N

June 2021

Brushless DC motors abbreviated as BLDC motors is a synchronous motor using a direct current power supply. As the name itself says unlike earlier dc motors these motors don't use brushes for misalignment of stator and rotor magnetic fields. This job is done by ESC electronic speed controllers in here.

- BLDC motors have a rotor which is a permanent magnet and a stator which is an electromagnet powered by direct current electric power.
- Stator has a 3 phase windings and all 3 phases are supplied with dc current.
- A rotating magnetic field(RMF) is generated by the stator coils by systematic excitation of the stator coils.
- Due to this RMF which is always ensured to be misaligned with the rotor field, produces a torque in the rotor.
- Whenever rotor fields tries to align with the stator field the excitation of coils is altered in such a way that it is not able to do so thus keeping the rotor rotating.
- In brushed motors the soft brush material wears down due to friction thus it needs regular maintenance which is not the case in BLDC motors.
- BLDC motors come in two categories they are inrunners in which rotors are inside the stator and outrunners in which rotor is outside to stator.

Electronic Speed Controllers abbreviated as ESC is an electronic circuit used to regulate speed of an electric motor. ESCs work by feedback mechanism. They information about the rotor position,speed and allows us to control the motor by making appropriate changes to power supply(Increase or decrease voltage in brushed motors and switching on or off of different coils in brushless motors).

- In BLDC motors Hall effect sensors or back emf sensors are used to know the position on rotor with respect to the stator coils. ESC takes this information to systematically excite some and de-excite other coils to maintain a steady torque.
- The speed of the rotor can increased or decreased by increasing or decreasing the switching speed respectively by ESC. This is very important in devices in which wide range of rotor speed is requried.
- ESCs also enable reversing of direction of rotation.

For machines which only use DC power like ours BLDC motors are more advantageous than brushed motors. BLDC motors reduce cost of maintenance and also has higher output power to size ratio. The ESCs used with BLDC motors allow a wide range of speed variation which is vital for our machine.