

Whitepaper

Seconds out for: Brushed vs. Brushless



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When making the case for brushed permanent magnet DC motors versus brushless DC motor technology, one first needs to understand why use DC motors instead of AC motors in the first place. There are several reasons for making this choice but to be sure each technology has its advantages and disadvantages for any given application.

DC motors typically have a greater power to frame size output. Simply put DC motors compared to AC motors are more powerful in a given frame size. This can be helpful for quick acceleration and deceleration times. Another reason is DC motors lend themselves to greater controllability and higher precision. DC motors work well in low voltage conditions and they are more efficient over a wider speed range.

Now to make the case for Permanent Magnet Brushed DC (to be referred to as PMDC motors) compared to Brushless technology (referred to as BLDC). We had the product managers at Dunkermotoren have this discussion and make their case. Stefan is the Product Manager for Dunkermotoren's GR series of PMDC motors and Michael is the Product Manager for Dunkermotoren's BG series of BLDC motors. The following is a summary of the discussion that took place.

Stefan: The use of all DC motors, brush and brushless is growing. While we see BLDC motors growing more quickly than PMDC, both market segments are growing. And in actuality there are far more PMDC motors produced globally than BLDC. DC motors in general will continue to provide a cost effective solution for applications that require good speed control and power in a compact size.

Michael: The core issue with DC motors is how to create a magnetic field which achieves rotary movement of the motor shaft. A PMDC uses mechanical commutation and BLDC uses electronic commutation. Mechanical commutation requires a wear part and therefore limits the service life of the motor. BLDC motors offer a long life, higher power to frame size and greater controllability and higher efficiencies than PMDC.

Stefan: It is true that the lifetime of a BLDC motor will be greater than that of a PMDC motor, but at what cost? Also, if you look at the automotive market as an example, the lifetime of the PMDC motor is sufficient for the application. PMDC motors are a perfect fit for applications where "infinite" service life is not necessary. Why pay for something you do not need.

Michael: The costs for BLDC have steadily declined over the years as the power transistors needed for the commutation have become more economical due to economies of scale. Let us discuss applications that require high acceleration torque, low acceleration times and the need for highly controlled motion profiles. A BLDC motor provides this type of solution that a PMDC motor cannot. We can also discuss about increased electrical interference caused by the mechanical commutation of PMDC. Finally, BLDC have better heat dissipation as the electrical windings are on the "outside" (stator) as opposed to the PMDC where the electrical windings are on the "inside" (armature).

Stefan: Brush motors are very easy to commission. Two wires and 12 V (for example) and you are up and running. Feedback can be achieved with an encoder and then controllability can be achieved at relatively low cost. There is also something to be said about tried and true methods of creating rotary torque.

Michael: Now your age is showing! BLDC motors can have integrated electronics which can also accept a simple two wire input and you are also up and running. Commissioning can be just as easy as PMDC. And these electronics can provide many other valuable benefits. Multiple move profiles, monitoring internal heat, sensing small changes in the load provide an extra level of preventive maintenance for the system.

Stefan: The fact that a PMDC motor is more economical to manufacture suggests a better sustainability. Low-cost components made from standard materials, coupled with highly energy-efficient, automated production lines make it unbeatable. In the case of PMDC motors, the controversial rare earth metals are also dispensed with.

Michael: Despite the perfected brush technology, PMDC motors have to be replaced after a certain lifetime. This is often done in a preventative way to avoid failures. Therefore, I regard the maintenance-free BLDC motors as significantly more sustainable. If a long service life is not required, PMDC motors still gain acceptance through their high efficiency and lower material and energy consumption due to the high-power density.

We invite you to make your own analysis of which technology is right for your application.

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