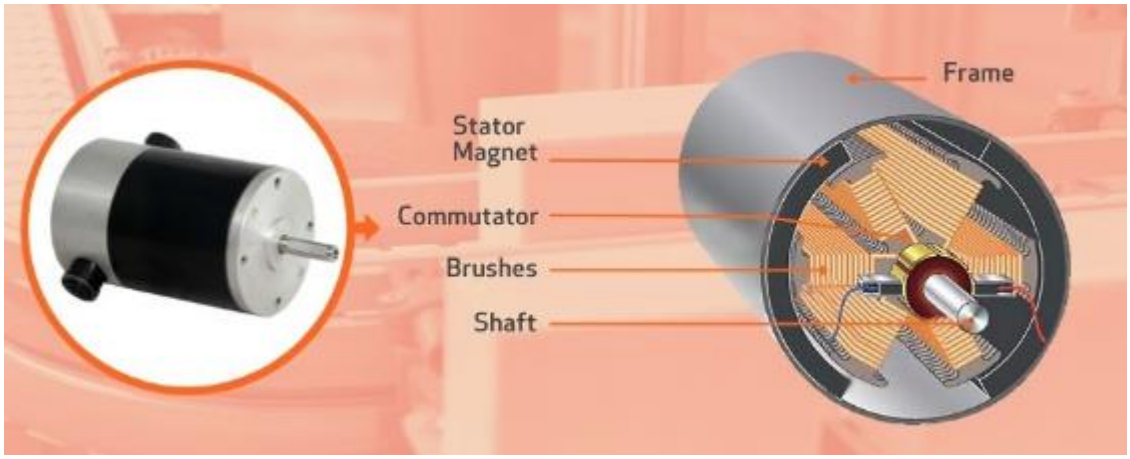
SNS College of Technology, Coimbatore-35

19MEE402 Hybrid Technology

UNIT 3-REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

Permanent Magnet Motor drives

Permanent magnet motor drives utilize magnets to generate a magnetic field, eliminating the need for external electrical power to create a magnetic field. Here's a brief overview:



A PMDC motor has two major components

Stator

The stator is the outer part of the PMDC motor which makes up its housing. Magnets are mounted on the inner side of the stator in such a way that the North and South pole of the magnets alternatively face the armature. Apart from housing the magnets, the stator also serves as a low reluctance return path for the magnetic

flux. In case the magnets somehow lose their power, an additional field coil is provided to compensate for the same.

Armature

The armature is the moving part of the PMDC motor which consists of winding, core, and commuter, and connects to the output shaft of the motor. In other motors, the rotor generates its own magnetic field by using a DC power source or induction. In other cases, it is simply made up of a ferromagnetic metal. PMDC motors however feature a different mechanism.

The core of the armature consists of laminations of steel sheets that are slotted circular and varnish insulated. The seel sheets work to reduce eddy current loss in the rotor.

The armature comprises slots containing armature winding. The commuter of the armature will be supplied with current by the brushes. It will then convert electrical power into motion. The armature is powered by connecting the brushes terminals to the DC supply.

The PMDC motor is considered to be a synchronous motor because the magnets within the motor are capable of achieving speeds equal to the excitation current.

Magnets used in PMDC motors come from three types of materials

Alnicos magnets

Alnicos feature a high residual flux density and low coercive magnetizing intensity. Hence, they are mostly used in applications where a low current is required at high voltage.

Ferritemagnets

Ferrite magnets tend to be lower in costs are are used in PMDC motors for cost-sensitive applications such as refrigerators, AC units or compressors.

Basic Principle: The motor relies on the interaction between the permanent magnets and the magnetic field generated by the stator winding to produce motion.
Rotor Construction: Permanent magnets are embedded in the rotor, creating a magnetic field that interacts with the stator's magnetic field, leading to rotation.

Advantages:

Efficiency: Generally more efficient due to reduced losses associated with field excitation.
Compact Size: Often more compact and lighter compared to traditional motors.
Dynamic Response: Faster response to changes in load conditions.
Reduced Maintenance: Absence of brushes (in brushless designs) reduces wear and maintenance requirements.
Energy Efficiency: Can contribute to energy savings, especially in variable-speed applications.

Disadvantages:

Cost: Permanent magnet materials (like neodymium) can be expensive.
Temperature Sensitivity: Performance can be affected by temperature variations.
Control Complexity: More complex control electronics required, especially in variable-speed applications.
Limited Temperature Range: Performance may degrade at extreme temperatures.

Applications:

Electric Vehicles (EVs): Widely used in electric vehicle propulsion systems for their efficiency and power-to-weight ratio.

Industrial Drives: Used in various industrial applications, especially where high efficiency and precise control are crucial.

Renewable Energy: Applied in wind turbine generators and other renewable energy systems.

Consumer Electronics: Found in appliances like fans, blowers, and computer hard drives.

Medical Equipment: Used in medical devices due to their compact size and efficiency.

Overall, permanent magnet motor drives are gaining popularity across various industries due to their efficiency and compact design, despite the challenges associated with cost and temperature sensitivity.