ELEMENTS OF ELECTRICAL ENGINEERING

Brushless DC Motor – Construction
Class 72

Jyothi T.N
Department of Electrical & Electronics Engineering

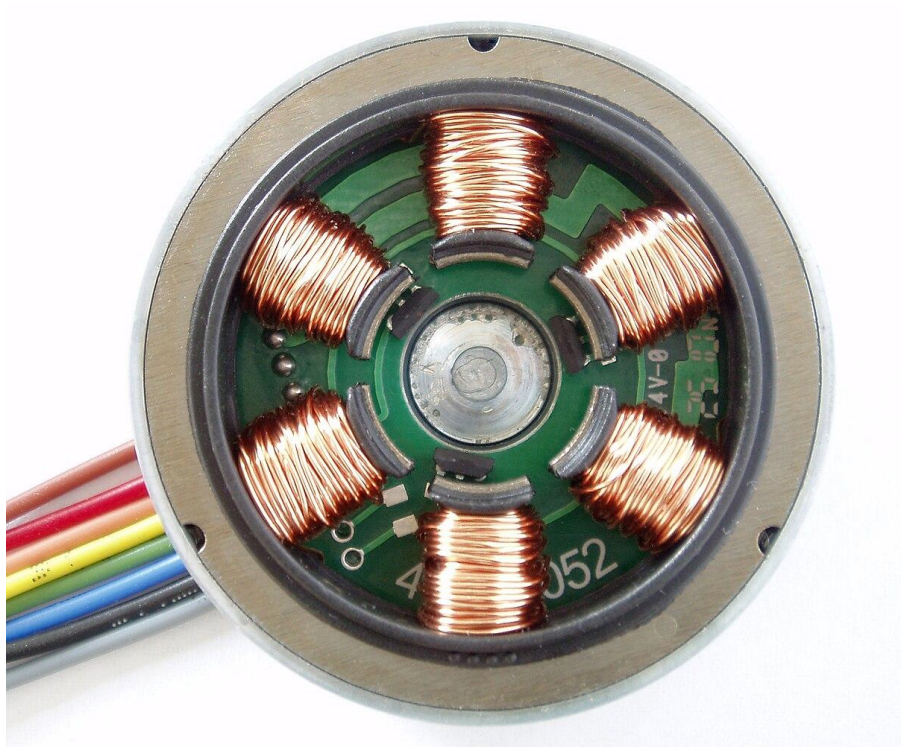
Brushless DC Motor - Introduction

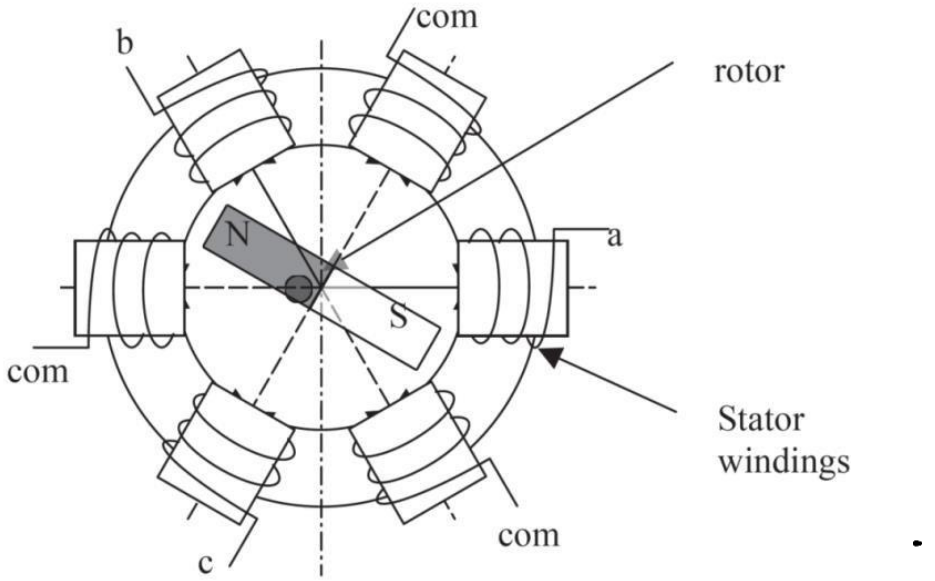
- A Brushless DC Motor (BLDC Motor) is an electric motor that runs on DC supply and uses **electronic commutation** instead of mechanical commutation as is the case with conventional DC Motors.

- Due to the absence of brushes and commutator as compared with conventional DC motors, BLDC Motors have advantages such as
  - Higher efficiency
  - Lower maintenance requirements
  - Longer life
  - More precise speed control
  - Quieter operation
  - Higher speed range
  - Higher torque to weight or volume ratio
  - Higher power density and smaller size

Brushless DC Motor – Stator Construction

- The Stator of a BLDC Motor consists of a three-phase winding which is usually star connected type.





https://upload.wikimedia.org/wikipedia/commons/thumb/0/0f/Stator_Winding_of_a_BLDC_Motor.jpg/1200px-Stator_Winding_of_a_BLDC_Motor.jpg

ELEMENTS OF ELECTRICAL ENGINEERING

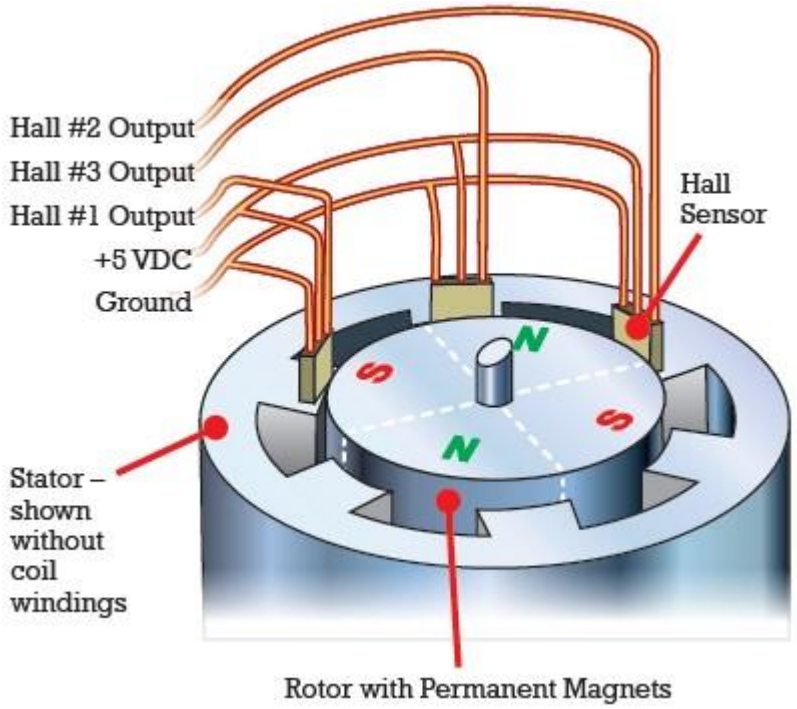
Brushless DC Motor – Rotor Construction

- The Rotor of a BLDC Motor consists of permanent magnets usually made of rare earth magnets. For e.g., Neodymium Iron Boron (NdFeB) magnets.

https://tymagnets.com/permanent-magnet-rotor-assembly/

Brushless DC Motor – Hall Sensors

- Hall Effect sensors on brushless DC motors provide the position of the magnetic pole on the motor rotor (rotating element) relative to the motor phase coil windings on the motor stator (stationary element).



- The Hall Effect sensors are used to indicate which stator phase winding to energize to generate the maximum motor torque in the desired direction of rotation.

Brushless DC Motor – Hall Sensorshttps://www.haydonkerkpittman.com/learningzone/whitepapers/connecting-brushless-dc-motors-to-electronic-controllers

ELEMENTS OF ELECTRICAL ENGINEERING

Brushless DC Motor – Electronic Speed Controller

The **Electronic Speed Controller (ESC)** is the essential electronic brain of a Brushless DC (BLDC) motor system. Its primary role is to convert the direct current (DC) power from a battery into a precisely timed, three-phase alternating current (AC) signal that drives the motor windings, replacing the mechanical commutation found in brushed motors

A BLDC ESC is a sophisticated piece of power electronics, typically comprising three main sections:

(i) Microcontroller unit
(ii) Power Stage (Inverter Bridge)
(iii) Gate Driver Circuit

https://mechtex.com/blog/a-comprehensive-guide-to-electronic-speed-controllers#:~:text=This%20conversion%20is%20achieved%20through,motor%20winding%20ensuring%20smooth%20operation.

ELEMENTS OF ELECTRICAL ENGINEERING

Text Book & References

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023

2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.

THANK YOU

Jyothi T N

Department of Electrical & Electronics Engineering

jyothitn@pes.edu