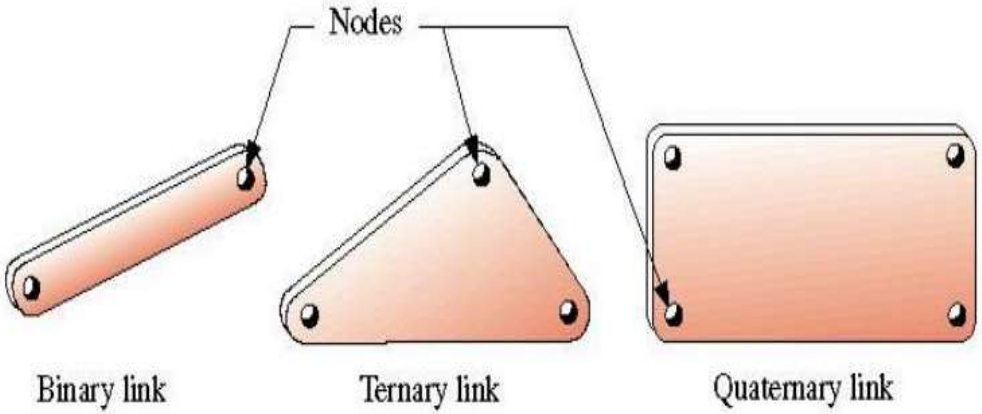
BASICS OF MECHANICS

Shravanth (18-ECE-38)

LINKS & JOINTS

- Link or Element is part of a machine which has a relative motion wrt some other part.
- Joint or Pair is always a connection between two links.

TYPES OF LINKS

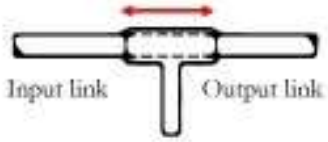


TYPES OF JOINTS

Translational motion

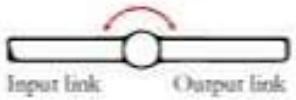
Linear joint (Type L)

Orthogonal joint (Type O)

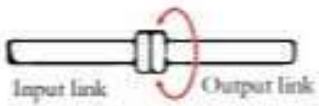


Rotary motion

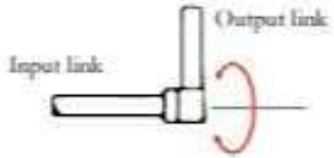
Rotational joint (Type R)

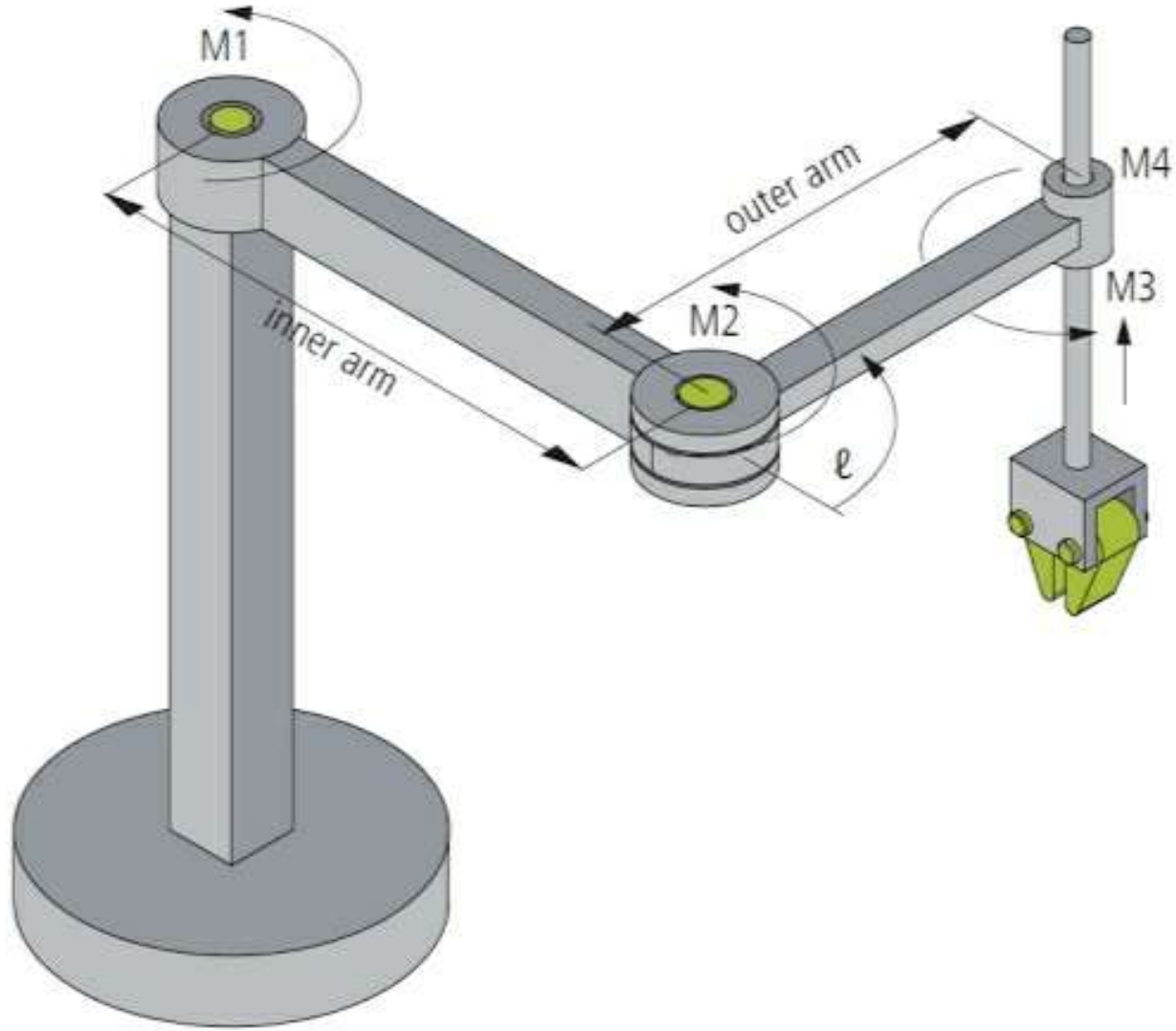


Twisting joint (Type T)



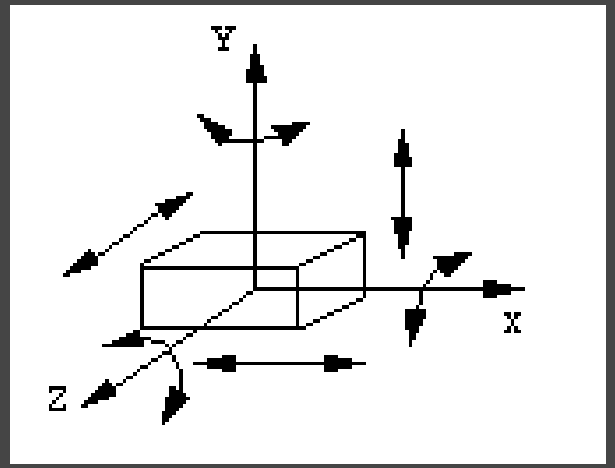
Revolving joint (Type V)



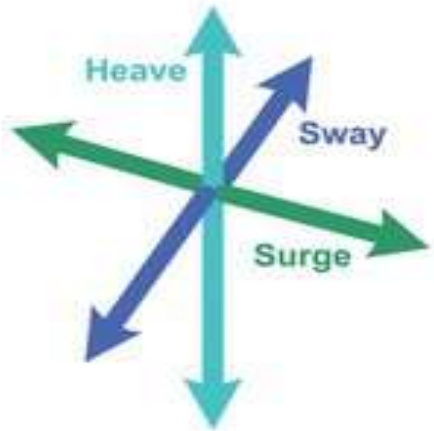

M1
outer arm
M4
M3
M2
inner arm
ℓ

DEGREES OF FREEDOM

- Motion possibilities of rigid bodies.
- 6 Degrees of Freedom.



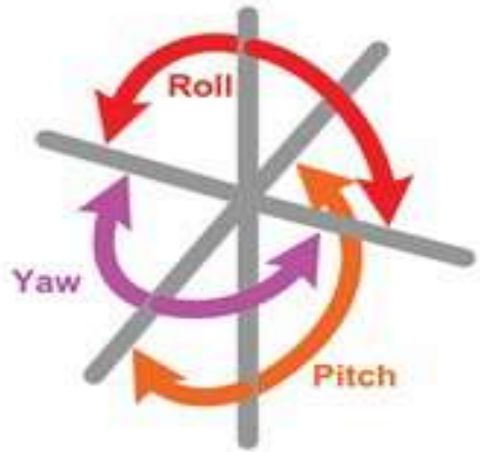
Translational Movement in Three Perpendicular Axes



Surge: Moving forward/backward
Heave: Moving up/down
Sway: Moving left/right

+

Rotational Movement about Three Perpendicular Axes



Roll: Tilting side to side
Pitch: Tilting forward and backward
Yaw: Turning left and right

=

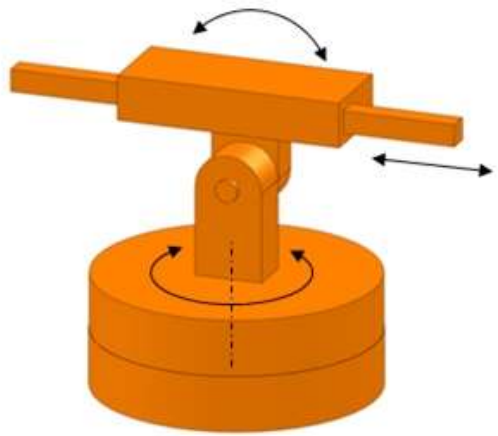
Six Degrees of Freedom

Surge Roll
Heave Pitch
Sway Yaw

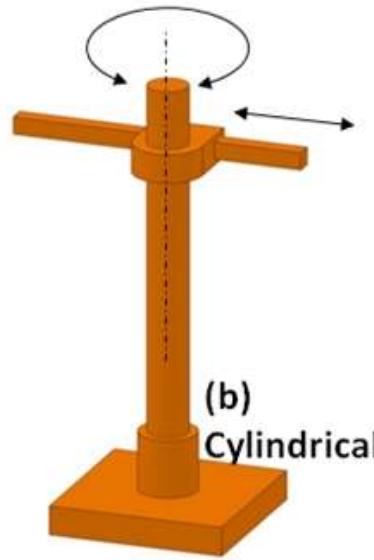
Roll Pitch Yaw

pitcher d**oor**

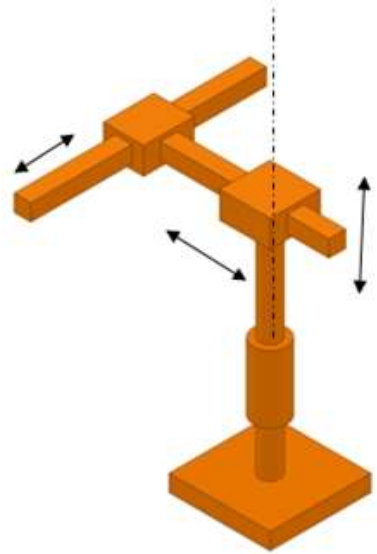
EXAMPLE



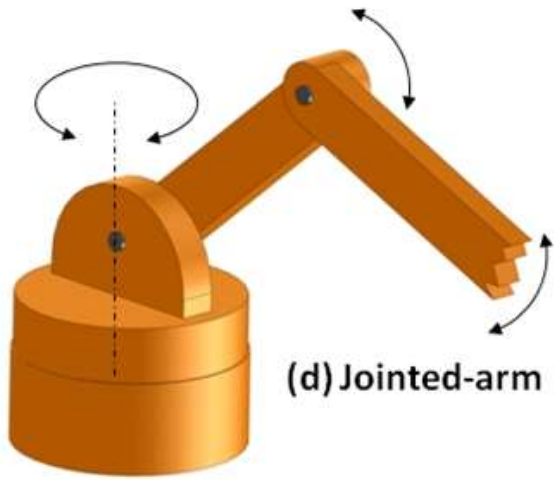
(a) Polar



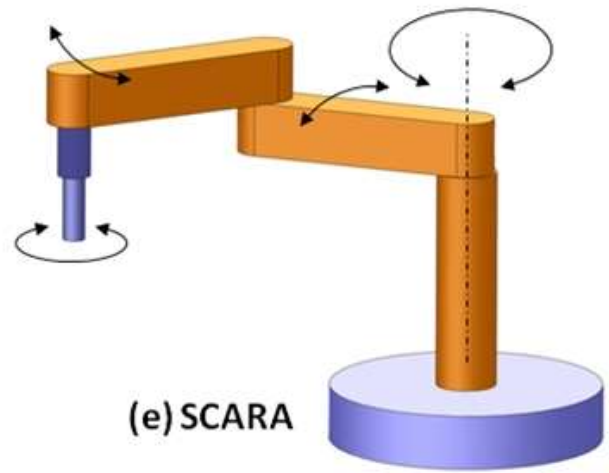
(b)
Cylindrical



(c) Cartesian



(d) Jointed-arm



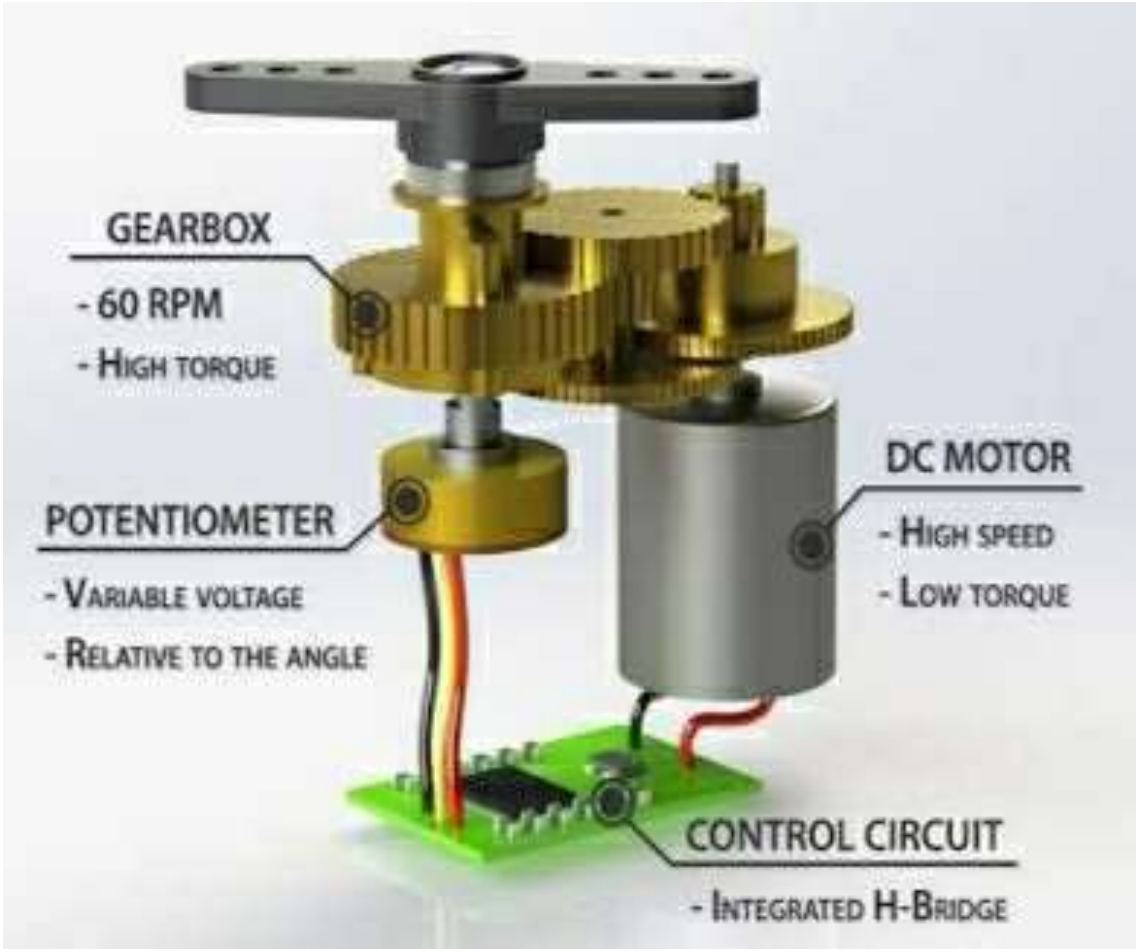
(e) SCARA

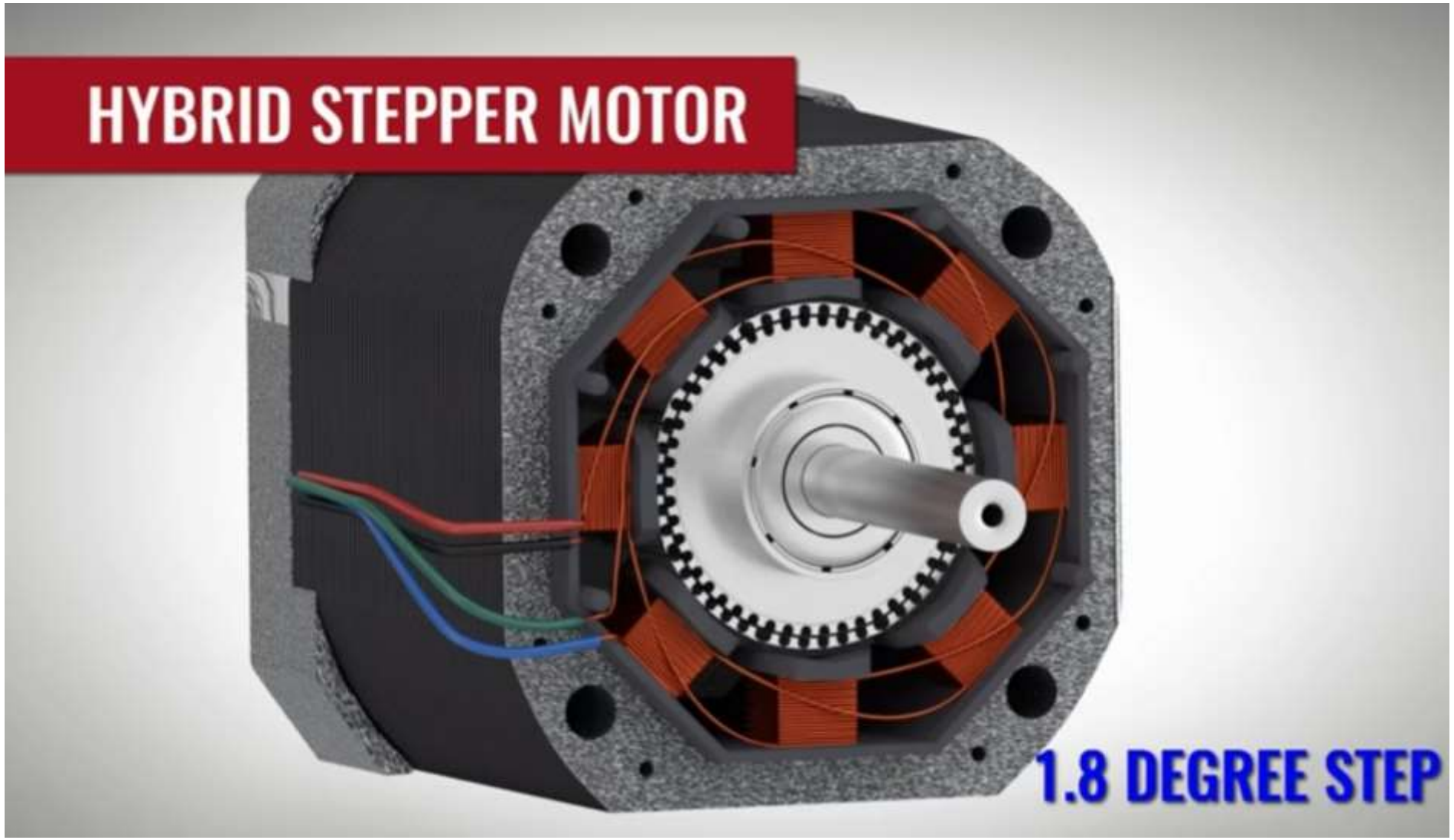
MOTORS & ACTUATORS

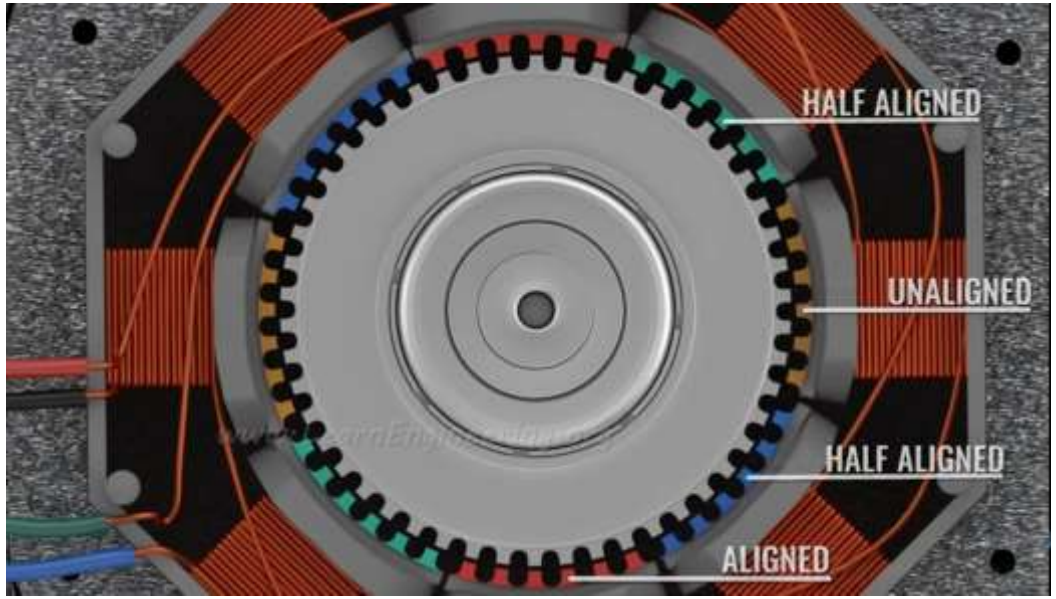
- An actuator is a motor that converts energy into torque which then moves or controls a mechanism or a system.
- Actuator needs both control signal and power supply.
- An electric motor is an electrical machine that converts electrical energy into mechanical energy.
- Motor only needs power supply.

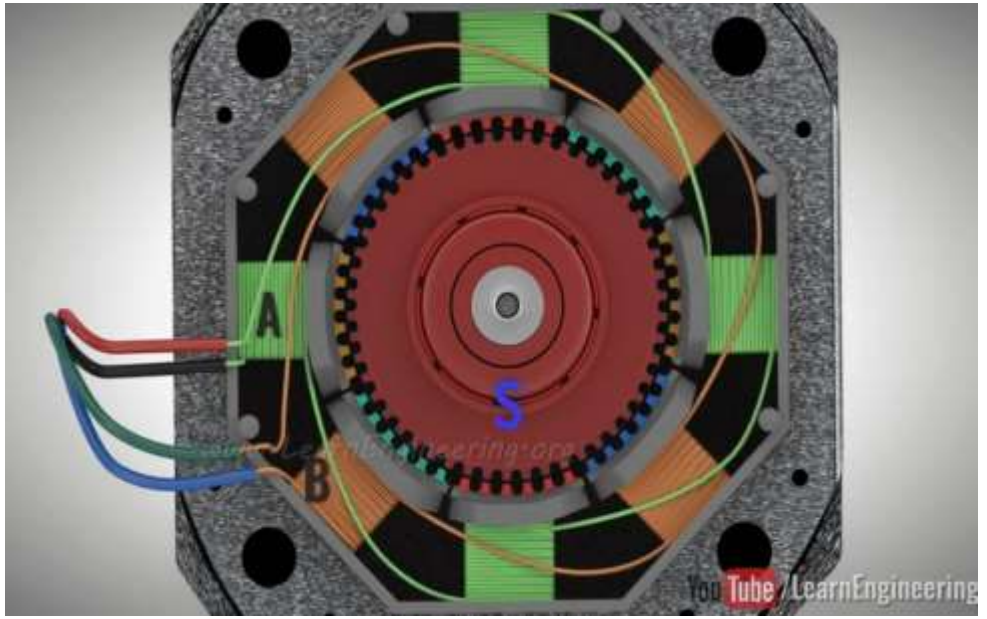
TYPES OF MOTORS

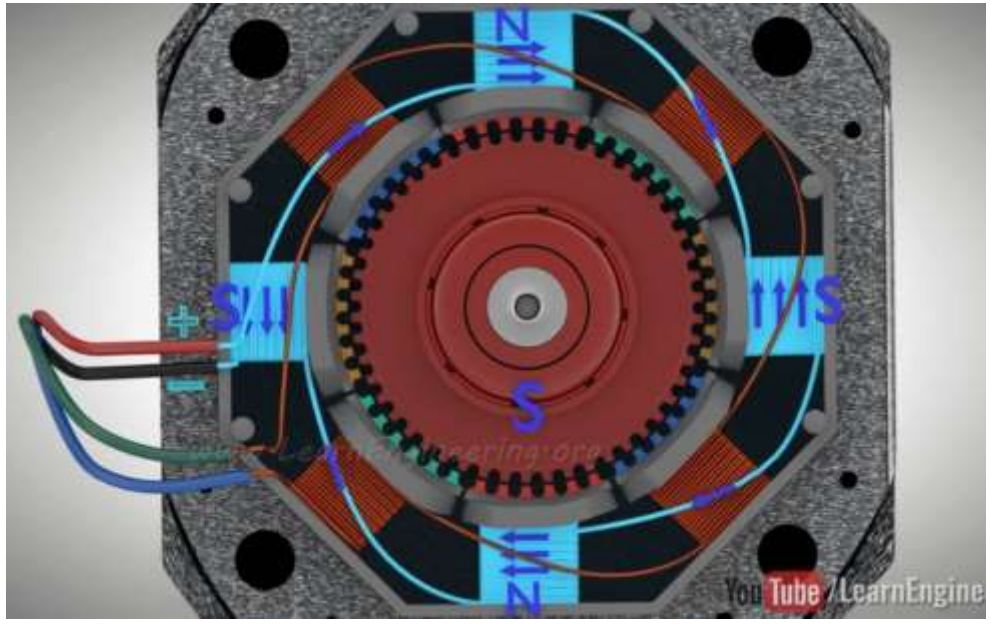
Servo Motor

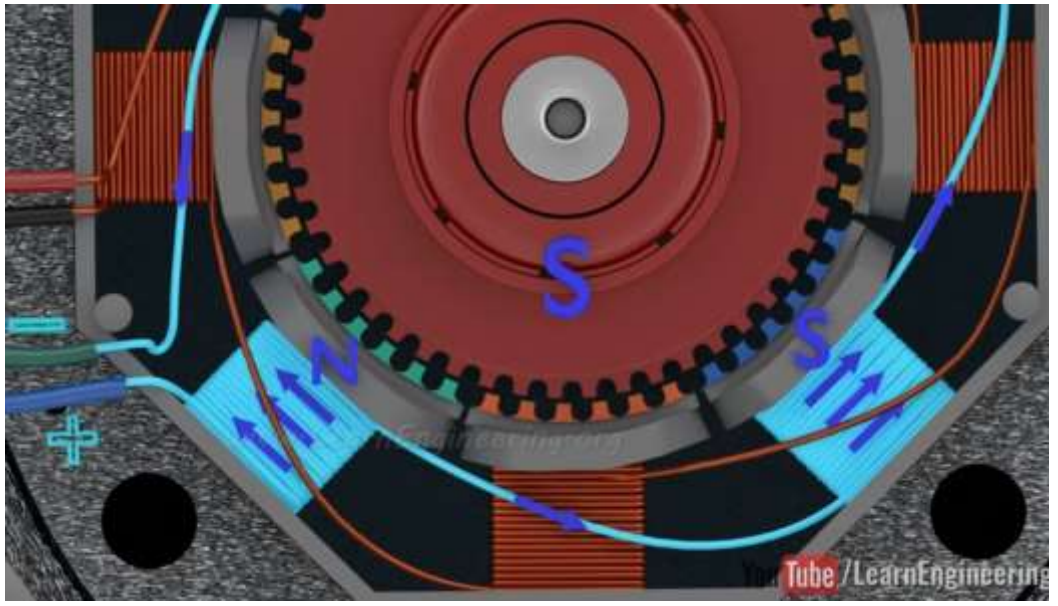

GEARBOX
- 60 RPM
- HIGH TORQUE
POTENTIOMETER
- VARIABLE VOLTAGE
- RELATIVE TO THE ANGLE
DC MOTOR
- HIGH SPEED
- LOW TORQUE
CONTROL CIRCUIT
- INTEGRATED H-BRIDGE


HYBRID STEPPER MOTOR
1.8 DEGREE STEP

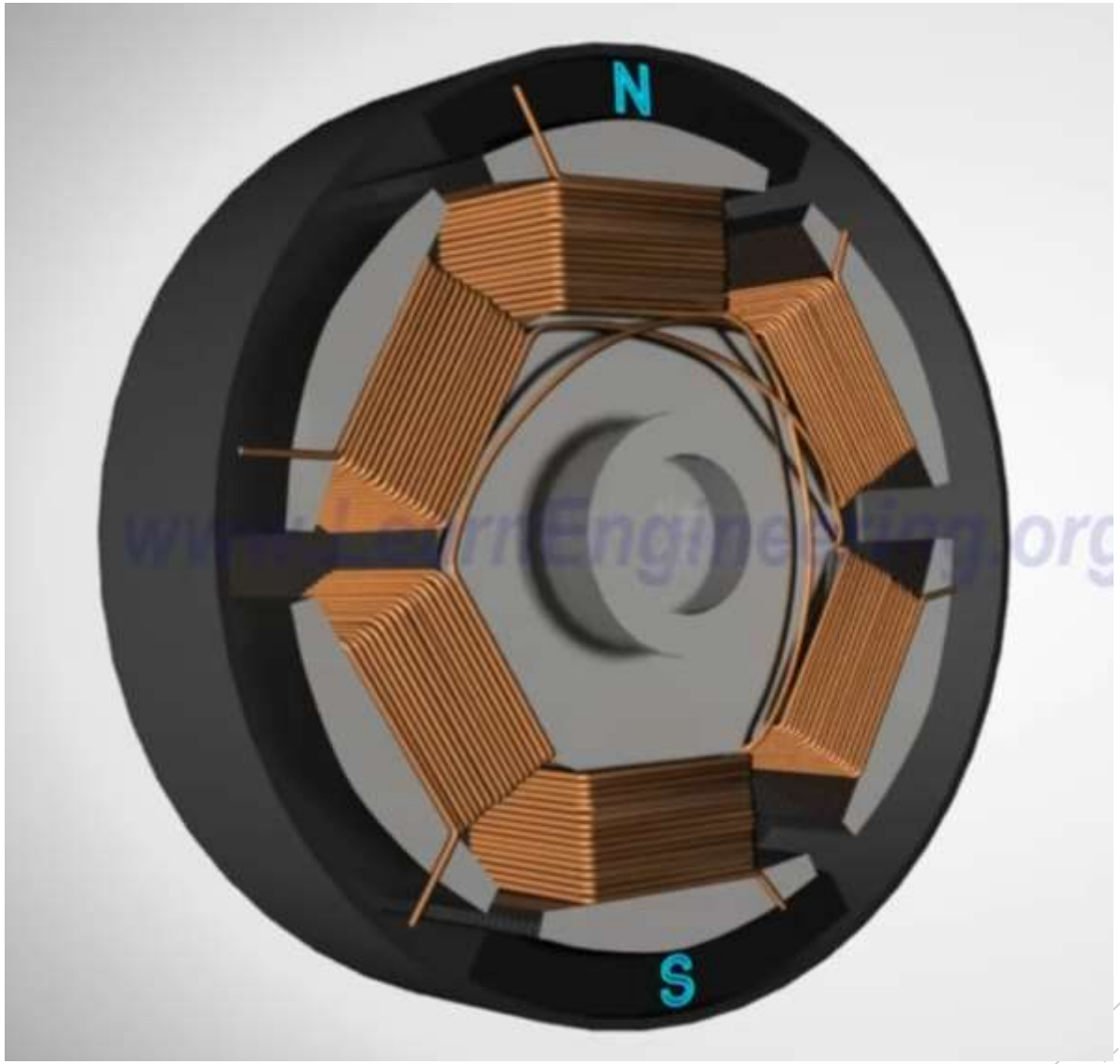

HALF ALIGNED
UNALIGNED
HALF ALIGNED
ALIGNED

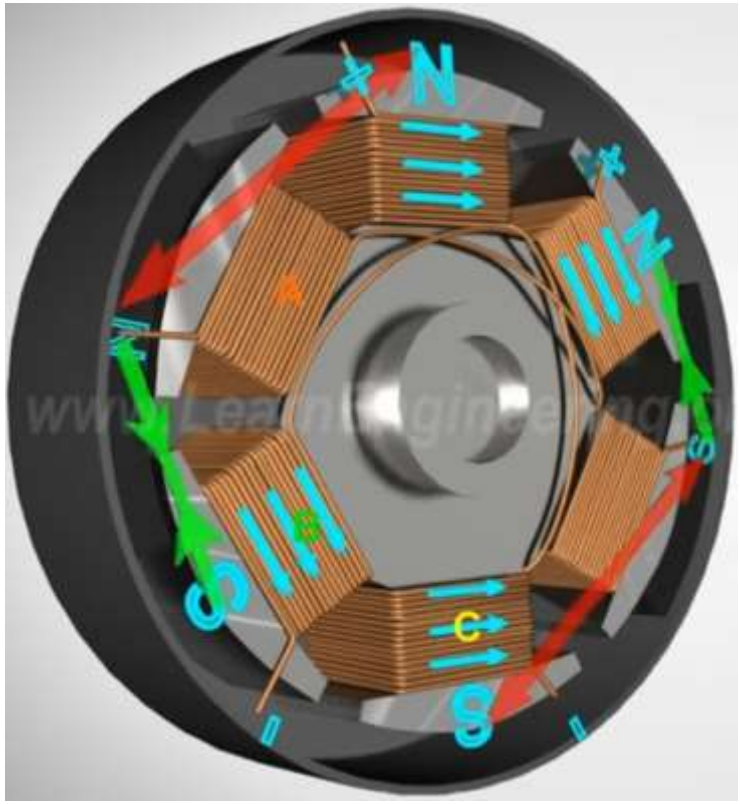

A
B
S
YouTube/LearnEngineering

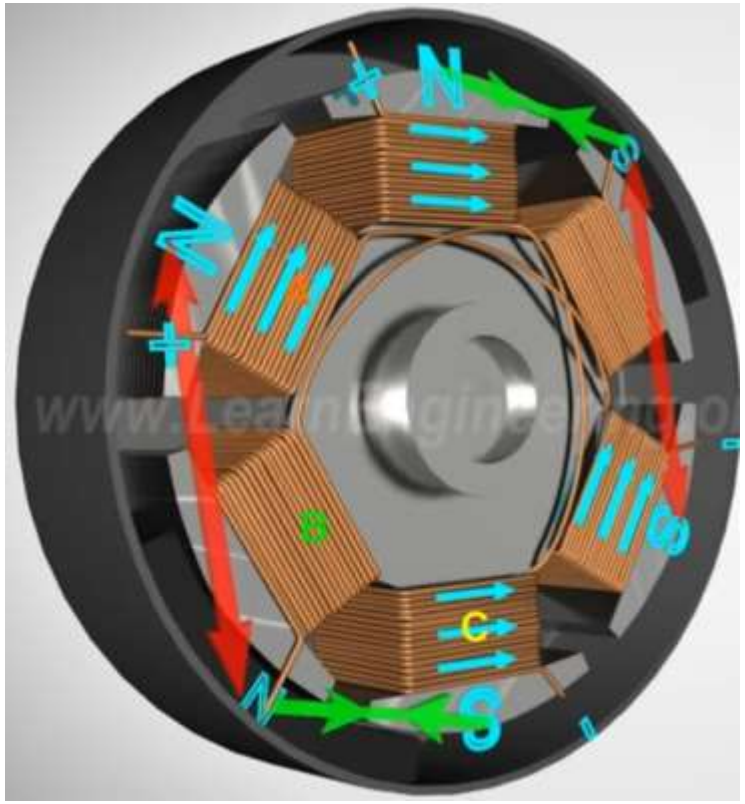

N
S
S
N
YouTube/LearnEngine


S
N
S
YouTube/LearnEngineering

BLDC Motor




N
S
S
N
S
C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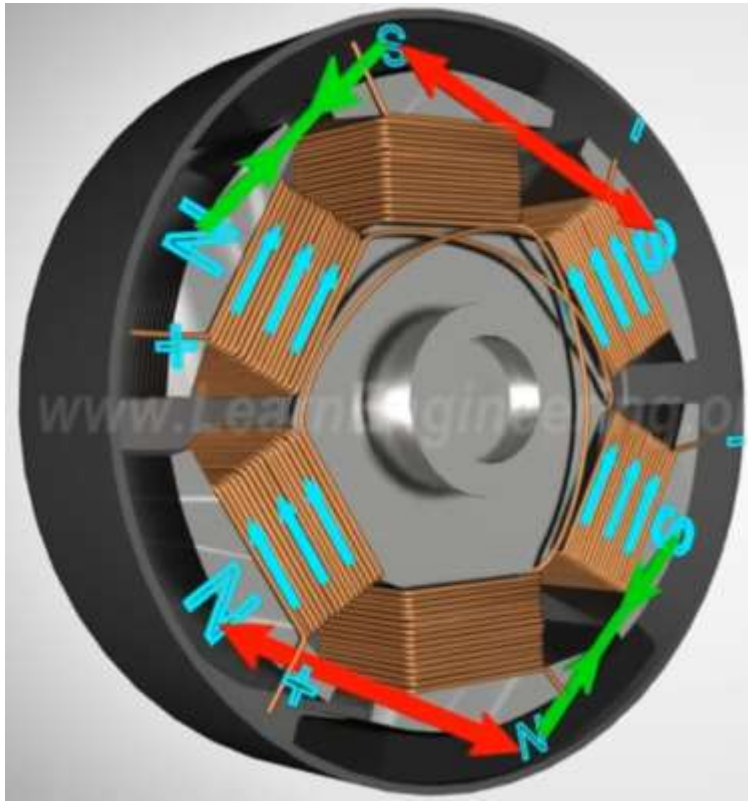
S
S
N
S
N
N

TYPES OF ACTUATORS

Based on Input Source

- Hydraulic
- Pneumatic
- Electrical

Based on its motion

- Linear
- Rotary