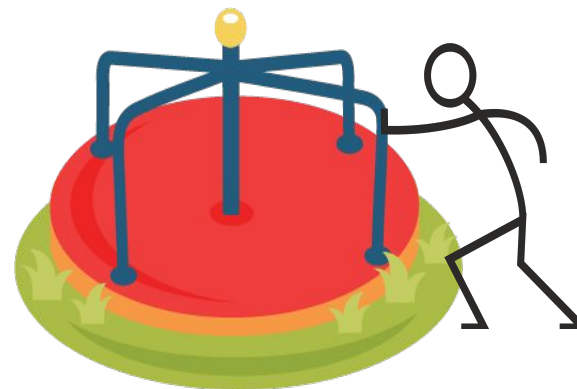
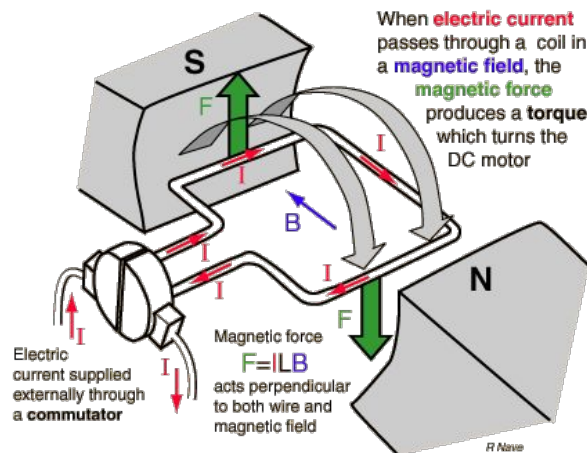


Today in Robotics: Actuation: Different Types of Motors

Spring 2026

Review for Motors:

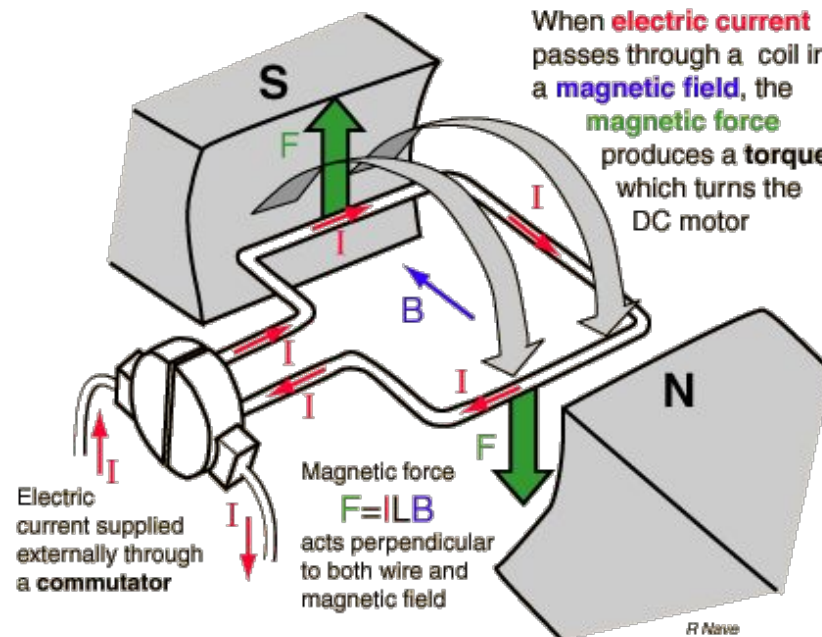
- In a motor, the electric current results in a magnetic field.
- In conjunction with permanent magnets, makes the motor shaft turn.
- The most basic motor type is the brushed DC motor.



Candy Time!

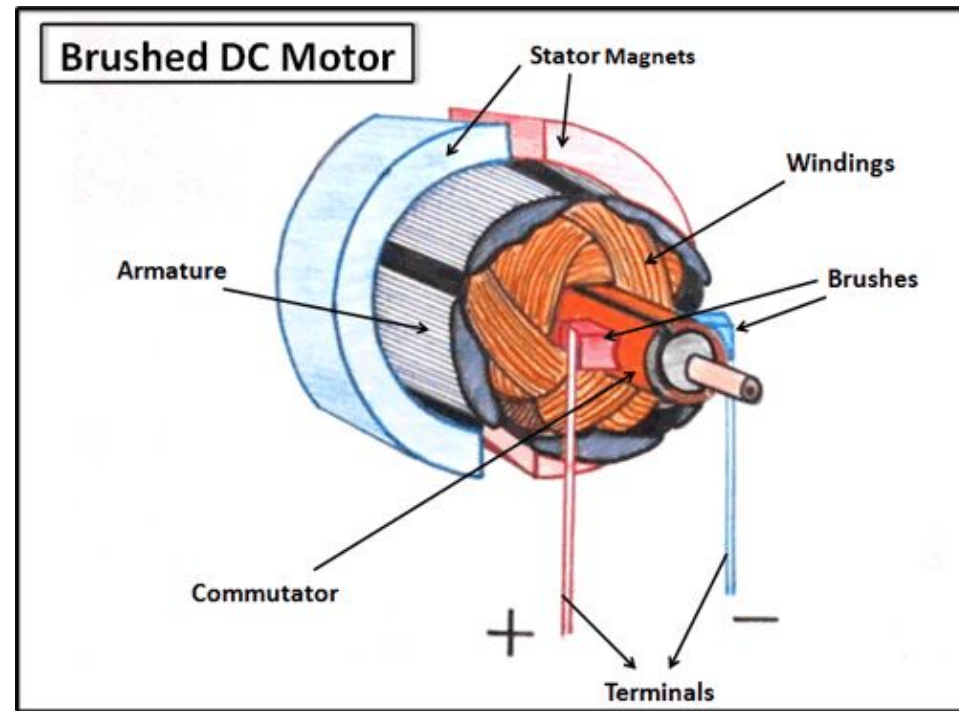
When, as the motor spins, does the current switch polarity?

When the loop is 90 degrees from its starting position in this picture (when the wire of the loop is perpendicular to the magnetic field).



Motors: Brushed DC

- Temporary magnetic fields interact with permanent magnets to make the motor spin.
- Requires commutation and brushes
 - Mechanical rather than electrical solution

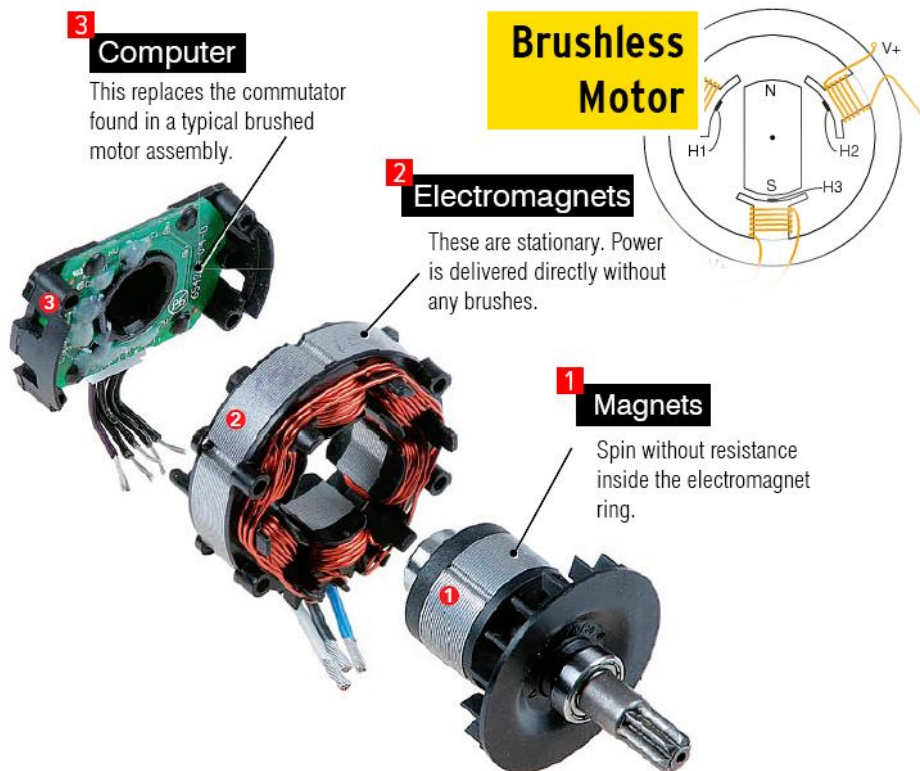


More Types of Motors!



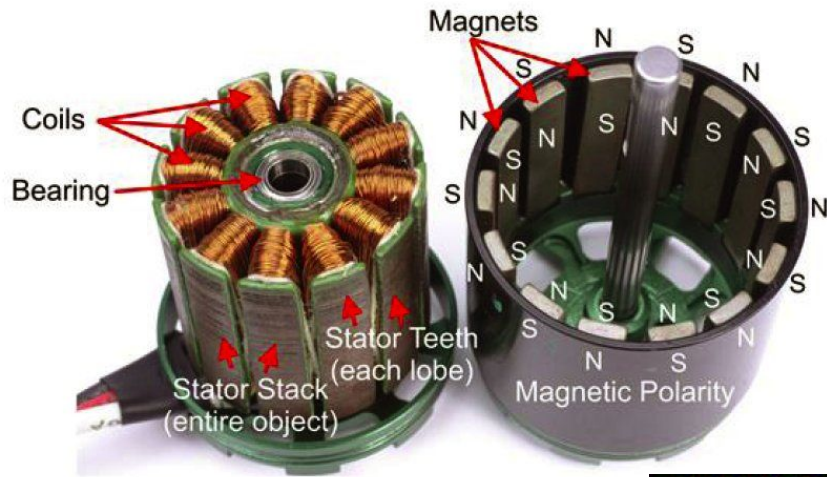
Actuators: Motors: Brushless DC

- No commutator/brushes
- Requires commutated control



Actuators: Motors: Brushless DC

OUTRUNNER COMPONENTS



- Electrical rather than mechanical
- Control the currents through a chip rather than through brushes.

SIDE BY SIDE COMPARISON

Comparing the DEWALT Brushless motor to a standard motor.



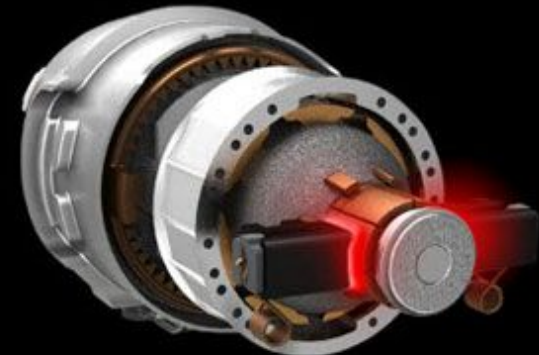
BRUSHLESS MOTOR

Green indicates electronic transfer of energy within the tool. This allows the tool to run longer between charges.



BRUSHED MOTOR

Red indicates friction caused by brushes on conventional motors. This slows the motor down and generates heat.



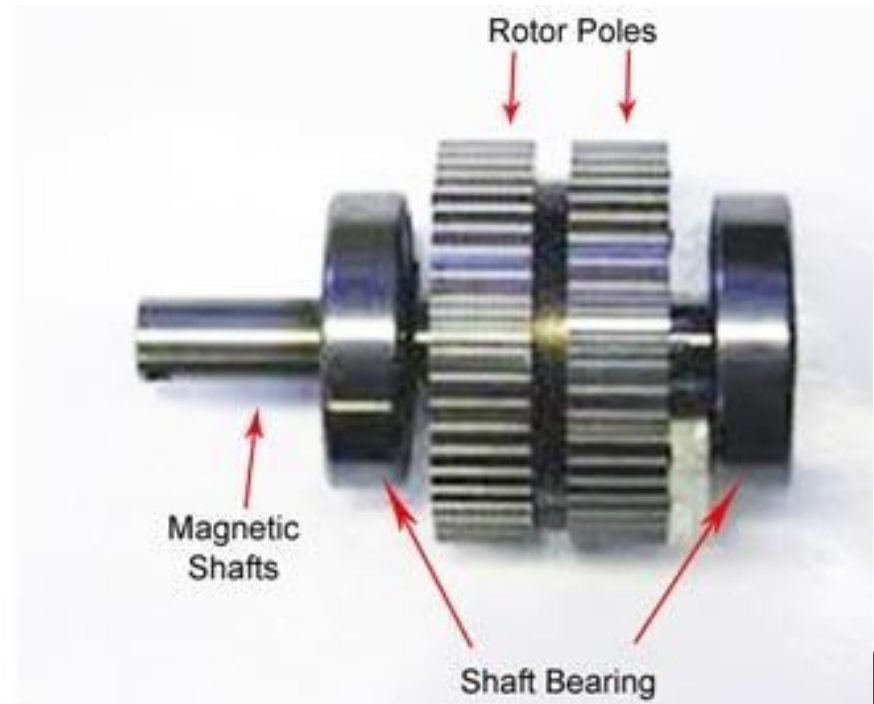
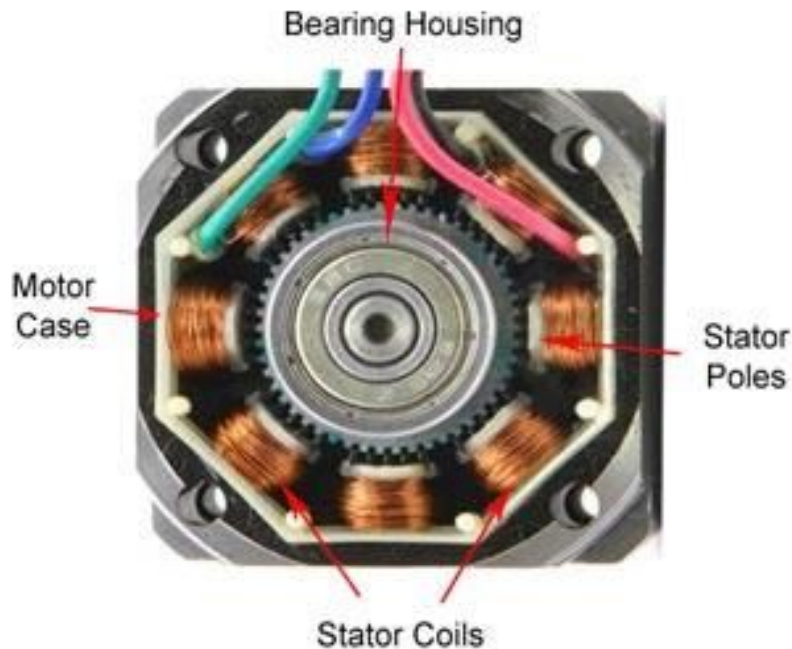
Actuators: Motors: Brushless DC

- Popular in hobby industry
- Fast + relatively powerful
- Speed \sim Voltage
- No brushes to wear out, long life
- High efficiency



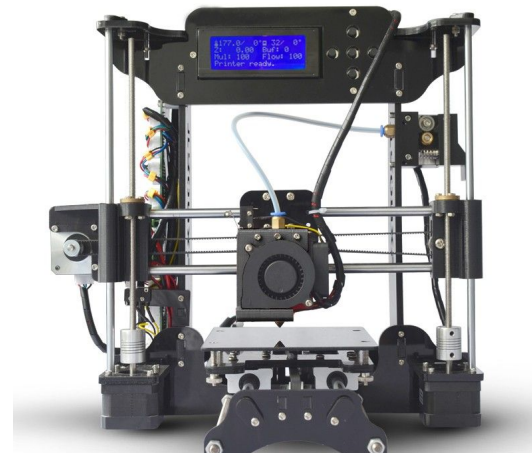
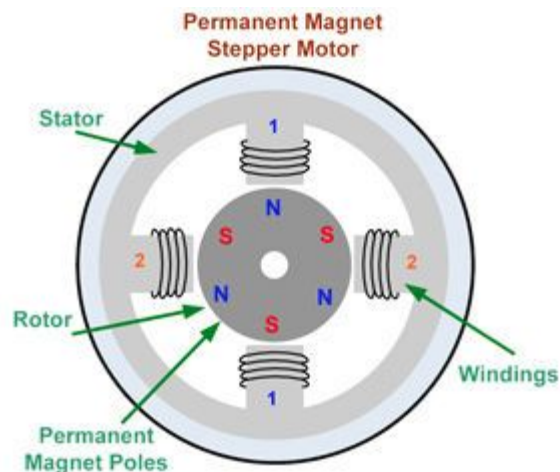
Actuators: Motors: Stepper

- Turn in steps
- Used for fine open-loop position control
- Very exact and very strong



Actuators: Motors: Stepper

- Permanent magnets are on the gear teeth and shaft.
- Turn on certain coils to make the shaft turn to a specific position.
- Benefits
 - No gearing necessary!
 - Know exactly how far you can go



Regular Versus Stepper Motors

- Brushed and brushless motors: before the coil reaches the permanent magnet, the next step is already energized.
- Stepper motors: the coil reaches the permanent magnet, and then the next step is energized.



Candy Time!

Why are stepper motors more powerful than other motors?

Stepper motor magnets can be more powerful because the loop can stop at every “tick.” If the same motors were applied in a regular motor, the loop get stuck at the magnets, even after the coil was reversed.

