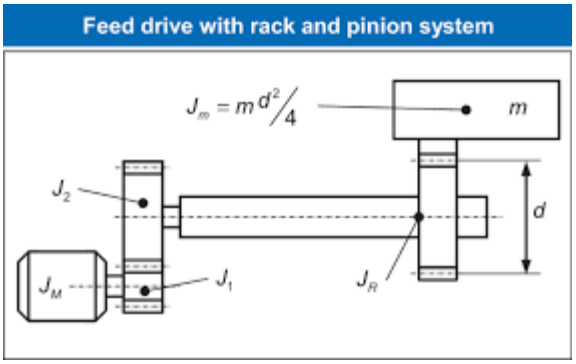
Feed Drives

Feed drives in CNC machines use motors to control the movement of machine components, such as the tool or workpiece. Two common types of motors used in feed drives are stepper motors and servo motors. Here's an overview of their principles:



Stepper Motors

Principle:

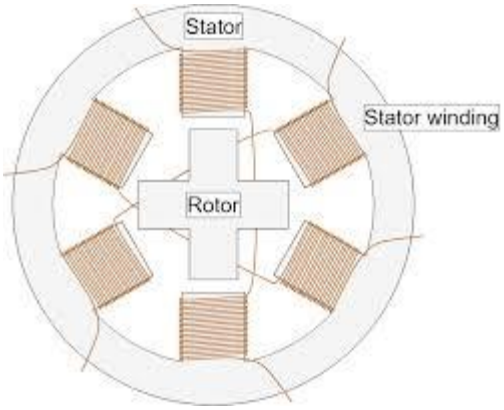
- Stepper motors convert digital pulses into mechanical shaft rotation.
- Each pulse moves the shaft a fixed angle, known as a step.
- Common step angles include 1.8° (200 steps per revolution) or 0.9° (400 steps per revolution).
- They operate in open-loop control, meaning they move to a position based on the number of input pulses without feedback on position.

Advantages:

- Simple control using digital pulses.
- High precision and repeatability due to fixed step angles.
- Cost-effective for applications requiring low to medium torque.

Disadvantages:

- Lack of feedback can lead to missed steps or loss of position under high load or acceleration.
- Limited torque and speed capabilities compared to servo motors.



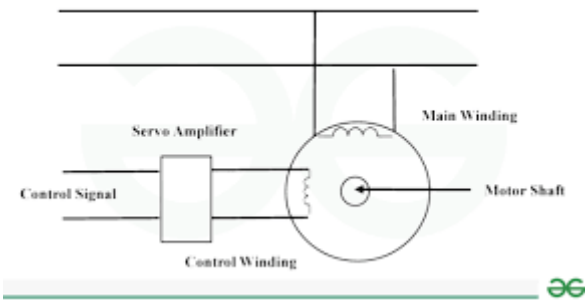
Servo Motors

Principle:

- Servo motors are part of a closed-loop control system that includes a motor, a feedback device (encoder or resolver), and a controller.
- The feedback device continuously monitors the motor's position, speed, and sometimes torque.
- The controller adjusts the motor's operation to match the desired position, speed, or torque, correcting any errors detected by the feedback.

Advantages:

- High accuracy and dynamic response due to continuous feedback and error correction.
- Capable of providing high torque and speed.
- Reliable performance under varying loads and conditions.



Disadvantages:

- More complex and expensive than stepper motors.

- Requires more sophisticated control systems and tuning.

Applications in CNC Machines

- **Stepper Motors:** Often used in applications where high precision and repeatability are required without the need for high torque or speed, such as in smaller CNC machines or for positioning the workpiece.
- **Servo Motors:** Preferred in applications requiring high performance, such as in large CNC machines, high-speed operations, and where continuous position feedback is essential to maintain accuracy and reliability.