SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF MECHATRONICS ENGINEERING

19MCT302 – CNC TECHNOLOGY

UNIT III – DRIVES & CONTROLS

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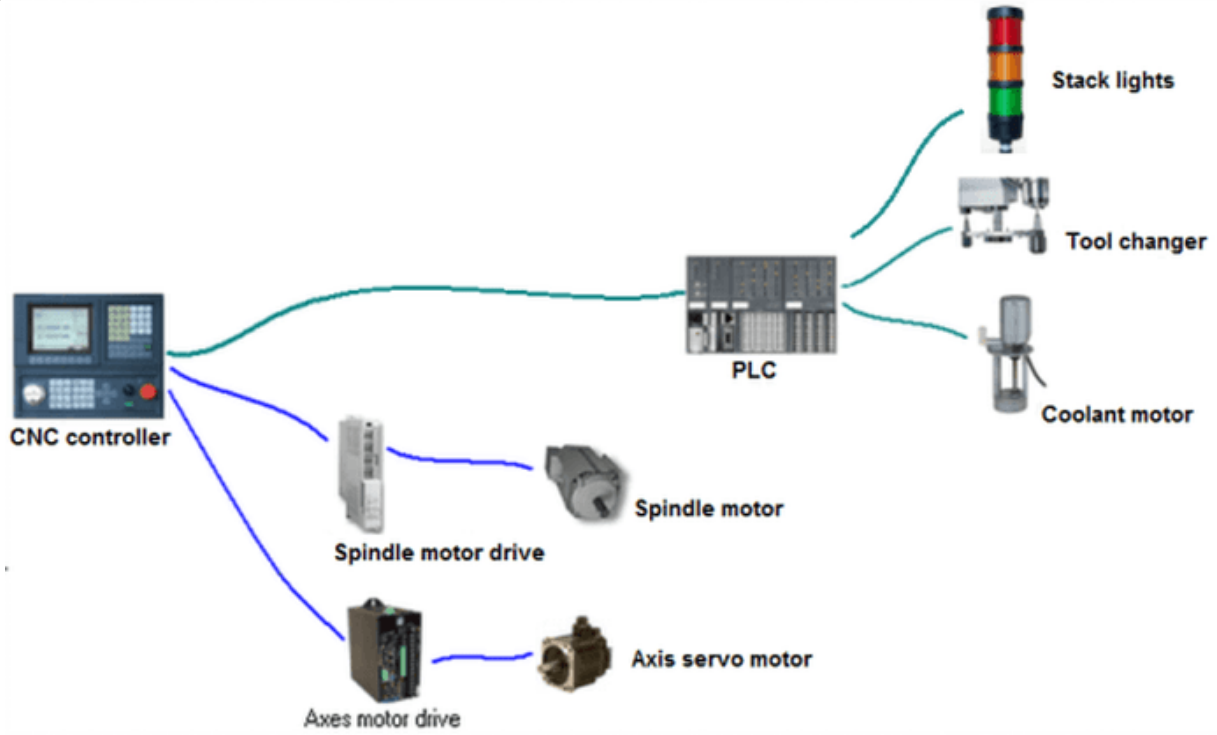
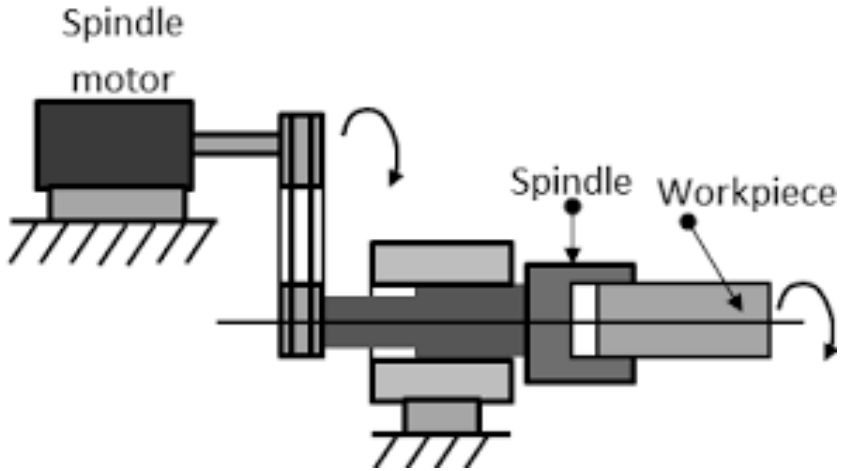
Introduction

- In a CNC (Computer Numerical Control) machine, drives and controls are essential components that play a crucial role in the accurate and automated machining of materials.
- These systems work together to precisely move and control the position of the cutting tool or workpiece.



SPINDLE DRIVE

- In a CNC (Computer Numerical Control) machine, Spindle drives are an integral part of machining equipment, such as lathes, milling machines, and CNC (Computer Numerical Control) machines.
- They are responsible for rotating the cutting tool, drill, or workpiece, enabling material removal and shaping processes.
- Spindle drives are available in various configurations to suit the requirements of different machining operations. Here are some key aspects of spindle drives:



SPINDLE DRIVE

Types of Spindle Drives:

Belt-Driven Spindle: In this configuration, a belt or pulley system is used to transmit power from the motor to the spindle. It allows for variable speed control by changing the position of the belt on the pulleys.

Gear-Driven Spindle: Gear-driven spindles use a set of gears to transfer power from the motor to the spindle. They provide consistent and precise speed control.

Direct-Drive Spindle: Direct-drive spindles do not use belts or gears but connect the motor directly to the spindle shaft. This design minimizes power loss and offers high torque and efficiency.

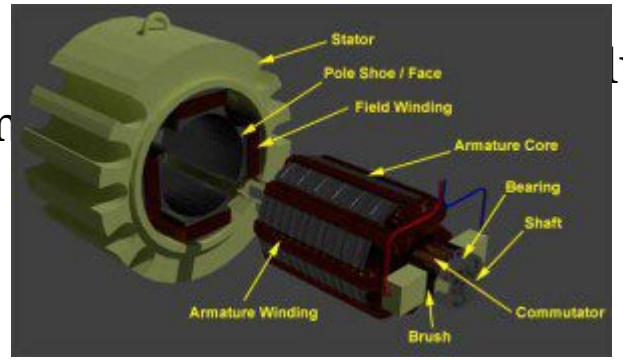
Integrated Motor Spindle: In this design, the motor and spindle are combined into a single unit. These spindles are compact and offer high power output, making them suitable for high-speed and high-torque applications.

DC SHUNT MOTOR

- A DC shunt motor is a type of direct current (DC) motor where the field winding (shunt winding) and the armature winding are connected in parallel.
- This configuration allows the motor to operate at a relatively constant speed, regardless of the load or current variations.
- Shunt motors provide good speed regulation and can handle both light and heavy loads effectively.
- They are known for their ability to maintain nearly constant speed under varying loads, making them suitable for applications where constant speed is crucial.

Application in CNC Machines:

- DC shunt motors were historically used in CNC machines, particularly in the early generations of CNC equipment.
- These motors provided reliable and consistent performance for many machining applications.
- CNC machines that employ ...lude milling machines, lathes, routers, and other industrial equipm...



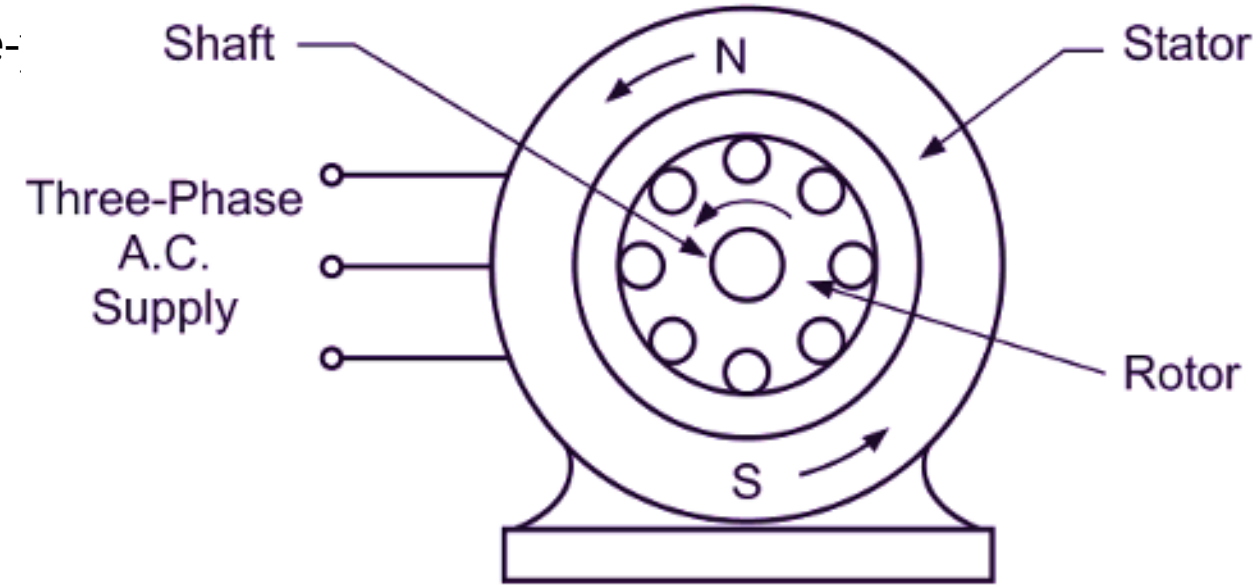
DC SHUNT MOTOR

- In modern CNC machines, AC servomotors and, in some cases, stepper motors are more commonly used. These motors offer precise control, a wide range of speeds, high efficiency, and reduced maintenance requirements.
- AC servomotors, in particular, are popular due to their high dynamic response, making them suitable for high-speed and high-precision machining.

  While DC shunt motors may still be found in some older CNC machines, many manufacturers have shifted to using more advanced motor technologies to meet the increasing demands for speed, precision, and efficiency in modern CNC machining applications.

3 PHASE AC INDUCTION MOTOR

- Three-phase induction motors are not commonly used as the main spindle drive motors in modern CNC (Computer Numerical Control) machines.
- Instead, CNC machines typically employ other motor types that offer more precise control, higher torque at low speeds, and better dynamic response.
- These motor types are better suited to meet the high-performance demands of CNC machining.
- However, three- spects of CNC machines.



3 PHASE AC INDUCTION MOTOR

Coolant Pumps: Three-phase induction motors are commonly used to drive the coolant pumps in CNC machines. These pumps circulate coolant, usually a mixture of water and cutting fluid, to cool the cutting tool and work piece during machining.

Conveyor Belts: CNC machines with automatic material handling or chip evacuation systems often use three-phase induction motors to drive conveyor belts. These belts transport work pieces, chips, or finished parts within the machine.

Work piece Rotation: Some CNC machines, especially those designed for specialized applications like rotary machining or lathe operations, may use three-phase induction motors to rotate the work piece or chuck.

Spindle Cooling: In some cases, three-phase induction motors are used to drive fans or blowers that provide cooling air for the machine's spindle or other components. Maintaining the appropriate operating temperature is crucial for spindle performance and longevity.