



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**

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## ***DEPARTMENT OF MECHATRONICS ENGINEERING*** **19MCT302 – CNC TECHNOLOGY**

### **UNIT II – STRUCTURE OF CNC MACHINE TOOLS**

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# Introduction

- In CNC (Computer Numerical Control) machines, guideways play a critical role in guiding and controlling the movement of the machine's cutting tool or workpiece with high precision.
- The choice of guideway type in CNC machines is crucial for achieving the desired level of accuracy, speed, and reliability.
- Here's how friction, anti-friction, and other types of guideways are commonly used in CNC machines:



# FRICION GUIDEWAYS



## Friction Guideways:

Friction guideways are a type of linear motion guidance system used to control the movement of components in various mechanical and industrial applications. They rely on the principle of friction between two contacting surfaces to provide support and regulate the motion of a component along a linear path.

- **Sliding Guideways:** These are simple, cost-effective guideways commonly found in some entry-level CNC machines. They use flat surfaces that slide against each other. While they are less expensive, they may not offer the same level of precision and smoothness as other types of guideways.
- **Dovetail Guideways:** Dovetail guideways are often used in CNC milling machines and some lathes. They provide good stability and precision for many machining applications.
- **V-Groove Guideways:** V-groove guideways can be found in CNC routers and some machining centers. They offer reasonable precision and are suitable for applications that don't require extremely high accuracy.



# ANTI-FRICTION GUIDEWAYS



## Anti - Friction Guideways:

Anti-friction guideways, also known as anti-friction linear motion systems, are specialized linear motion guidance systems designed to reduce friction and provide precise and smooth movement for various mechanical and industrial applications. Unlike friction guideways, which rely on the principle of friction between contacting surfaces, anti-friction guideways use rolling elements, such as balls or rollers, to minimize friction and deliver higher levels of precision and efficiency.

- **Ball Bearing Guideways:** CNC machines that require high precision and smooth motion often use ball bearing guideways. These guideways use recirculating balls to reduce friction and ensure precise linear motion. They are common in CNC machining centers and grinding machines.
- **Roller Bearing Guideways:** In heavy-duty CNC machines, such as large machining centers or industrial lathes, roller bearing guideways are preferred. They offer higher load capacity and stiffness compared to ball bearings.



# OTHER TYPES OF GUIDEWAYS



- **Magnetic Guideways:** Some advanced CNC machines, especially those used in semiconductor manufacturing and ultra-precision applications, use magnetic guideways. These guideways provide frictionless, highly precise motion and are well-suited for applications where even slight mechanical contact can introduce errors.
- **Air Bearings:** CNC machines requiring exceptional precision and ultra-smooth motion may incorporate air bearings. These guideways use a thin film of air to support the moving parts, minimizing friction and providing the highest levels of accuracy.
- **Hydrostatic Guideways:** In some specialized CNC machines, hydrostatic guideways are used. These guideways rely on a pressurized fluid film to support and guide the moving components, offering high stiffness and precision.



# GUIDEWAYS

- The choice between friction and anti-friction guide ways in CNC machines depends on the specific requirements of the application.
- For high-speed, high-precision machining, anti-friction guide ways like ball bearings or roller bearings are favored.
- Friction guide ways may be suitable for less demanding applications where cost is a significant consideration.
- It's essential to consider factors such as the type of machining, work piece material, required tolerances, and budget when selecting the appropriate guide way type for a CNC machine. Additionally, regular maintenance



and lubrication are crucial to ensure the longevity and



# ROTARY MOTION TO LINEAR MOTION



- Screw Mechanism
- Cam & Follower
- Crank & Slider Mechanism
- Rack & Pinion
- Cam & Follower
- Belt & Pulley
- Scotch Yoke Mechanism
- Linkages

