



Industrial Technology Virtual Learning

Advanced Metals/CNC Machine Operations

May 19, 2020



CNC Machine Operations: May 19, 2020

Objective/Learning Target:

At the conclusion of this assignment the students will understand the different machining operations performed with a CNC Machine. At the end of the assignment students knowledge of the subject will be checked with a short quiz.

Bell Ringer

What do you look for when inspecting finished work pieces?



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Computer Numerical Control (CNC) Review

CNC Machining, or Computer Numerical Control Machining, is a process which employs computerized controls and rotating multi-point cutting tools to progressively remove material from the work piece and produce a custom-designed part or product.



CNC Milling Operations

CNC Milling is a machining process suitable for producing high accuracy, high tolerance parts in prototype, one-off, and small to medium production runs. Parts are typically produced with tolerances ranging between +/- 0.001 in. to +/- 0.005 in.

The versatility of the milling process allows it to be used in a wide range of industries and for a variety of part features and designs, including slots, chamfers, threads, and pockets. **The most common CNC milling operations include:**

- **Face milling**
- **Plain milling**
- **Angular milling**
- **Form milling**



Face Milling

Face Milling refers to milling operations in which the cutting tool's axis of rotation is perpendicular to the surface of the work piece. The process employs face milling cutters.



Face Milling is used to create flat surfaces and contours on the finished piece and is capable of producing higher quality finishes than other milling processes.

Plain Milling

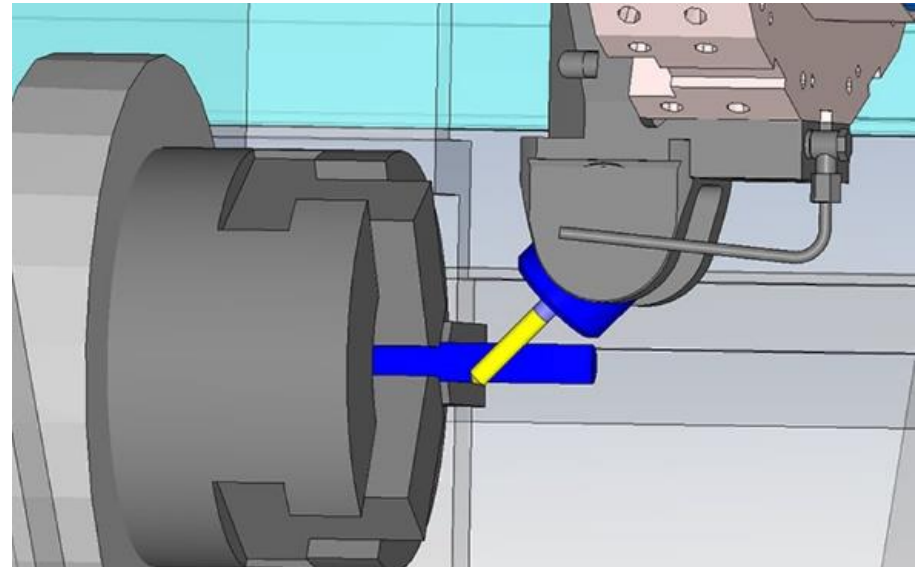
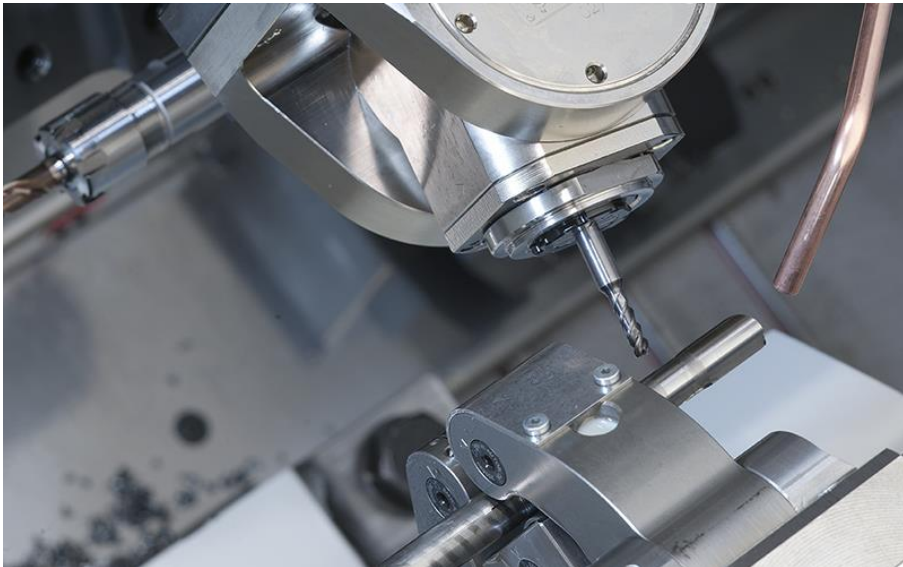
Plain milling, also known as surface, refers to milling operations in which the cutting tool's axis of rotation is parallel to the surface of the work piece. The process employs plain milling cutters.



Depending on the specifications of the milling application, such as the depth of the cut and the size of the work piece, both narrow and wide cutters are used.. If a plain milling application requires the removal of a large amount of material from the work piece

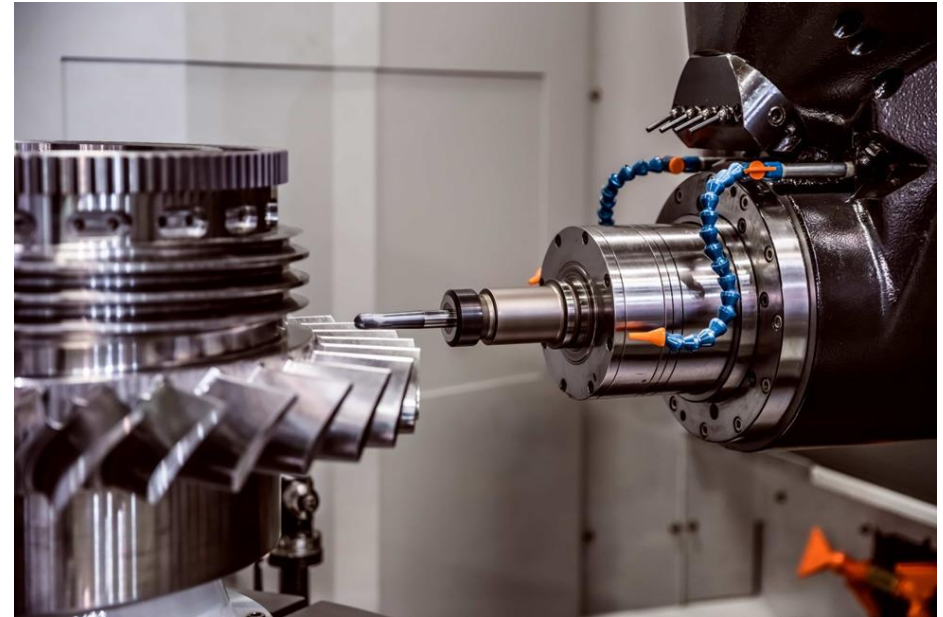
Angular Milling

Angular milling, also known as angle milling, refers to milling operations in which the cutting tool's axis of rotation is at an angle relative to the surface of the work piece. The process employs single-angle milling cutters—angled based on the particular design being machined—to produce angular features, such as chamfers, serrations, and grooves.



Form Milling

Form Milling refers to milling operations involving irregular surfaces, contours, and outlines, such as parts with curved and flat surfaces, or completely curved surfaces. The process employs formed milling cutters or fly cutters specialized for the particular application, such as convex, concave, and corner rounding cutters.



CNC Turning Operations

- CNC Turning is the most basic machining process, where the part is rotated while a single point cutting tool is moved parallel to the axis of rotation. **The most common CNC Turning operations include:**
 - **Taper Turning**
 - **Spherical Turning**
 - **Facing**
 - **Parting**
 - **Grooving**



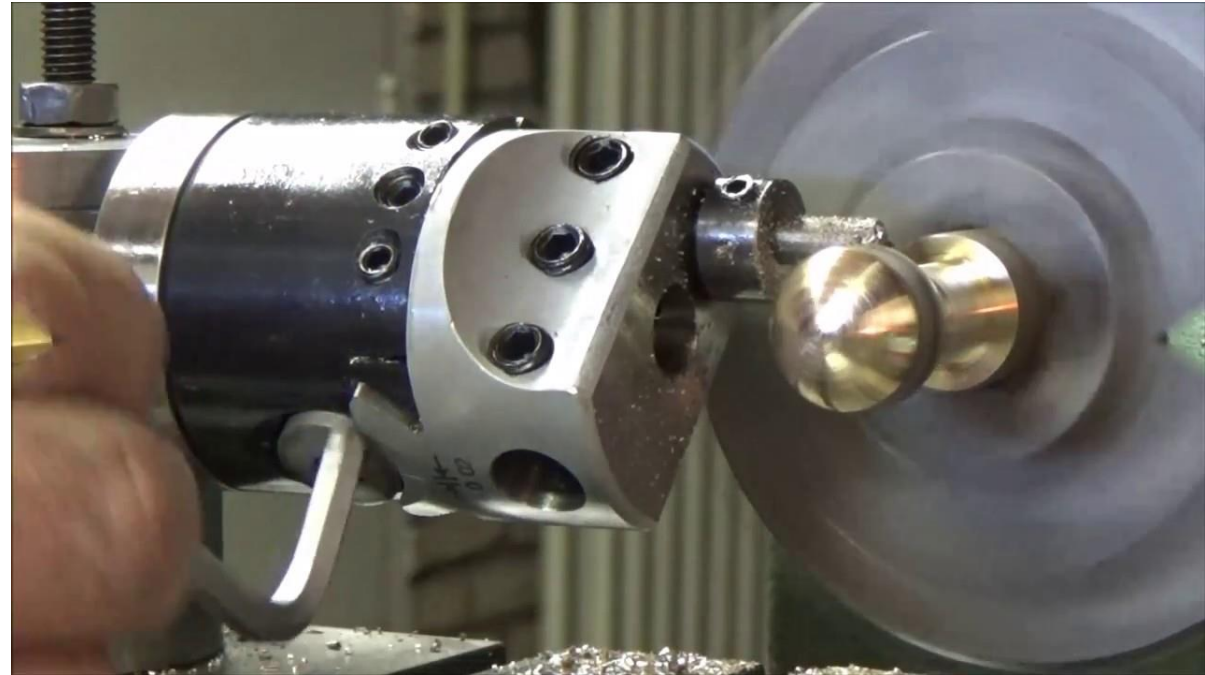
Taper Turning

Taper turning means, to produce a conical surface by gradual reduction or increase in diameter from a cylindrical work piece. This tapering operation has wide range of use in construction of machines.



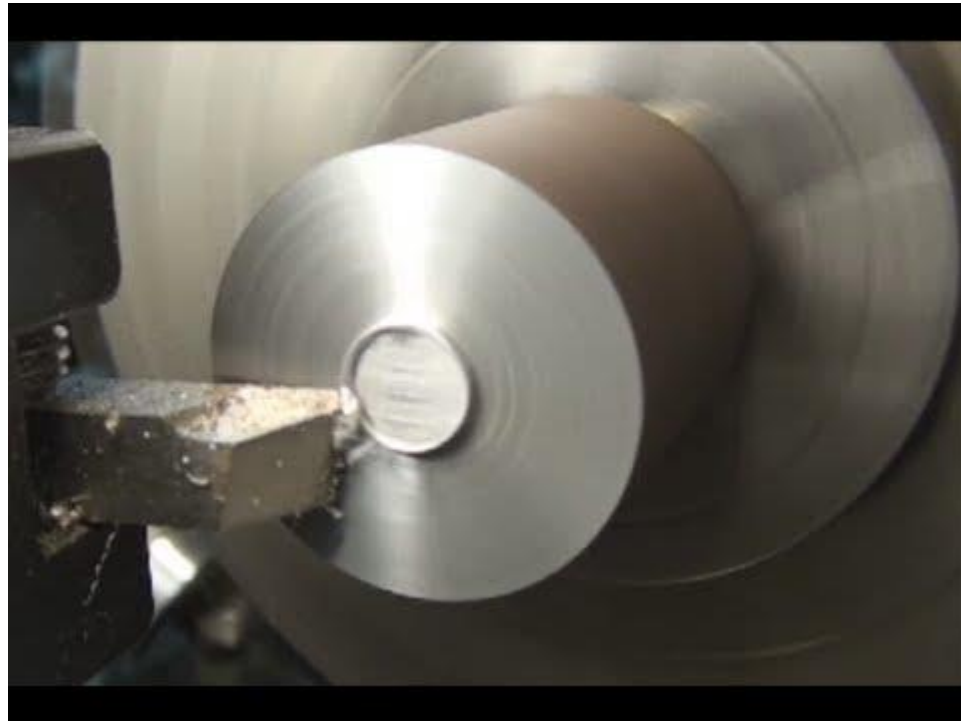
Spherical Turning

Spherical Turning means to produce a ball shape on the work piece.



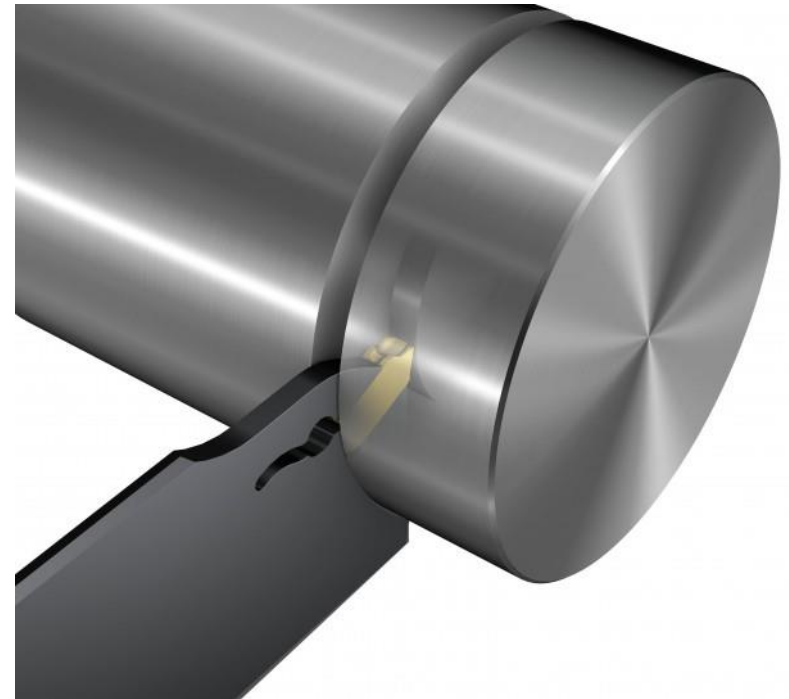
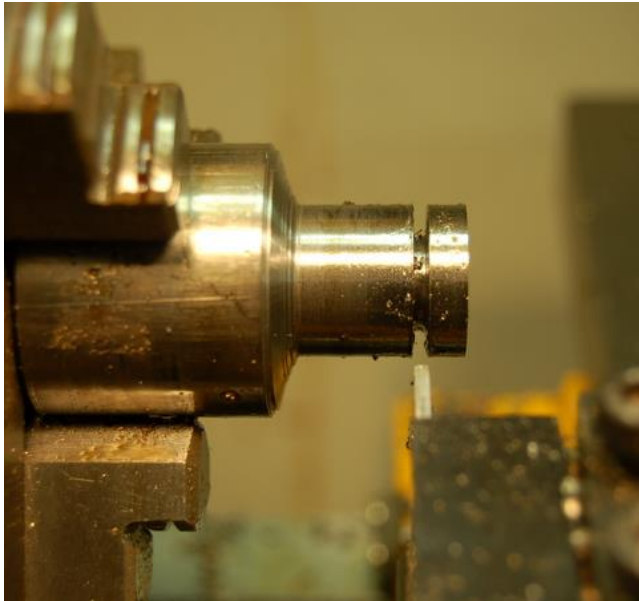
Facing

- Facing in the context of turning work involves moving the cutting tool at right angles to the axis of rotation of the rotating work piece. It is frequently the first operation performed in the production of the work piece.



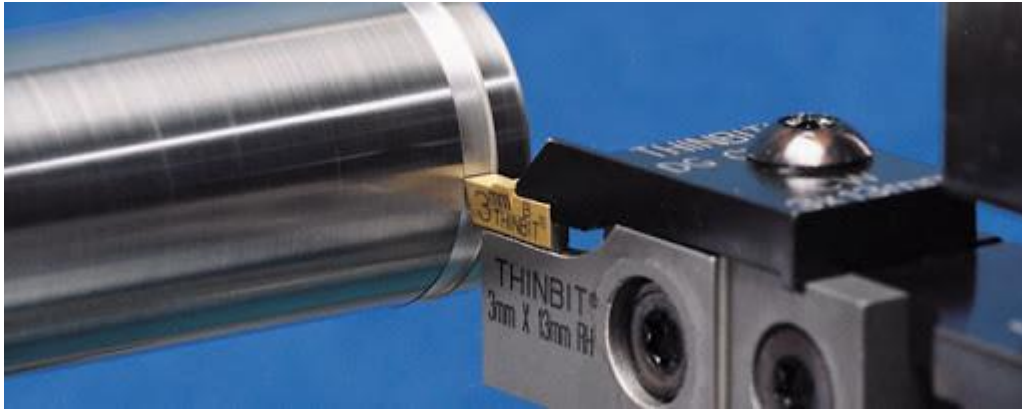
Parting

- This process, also called **parting off** or **cutoff**, is used to create deep grooves which will remove a completed or part-complete component from its parent stock.



Grooving

- Grooving is like parting, except that grooves are cut to a specific depth instead of severing a completed/part-complete component from the stock.



Other Non-Specific Turning Operations

- Boring
- Drilling
- Knurling
- Reaming
- Threading
- Polygonal turning

References

- <https://all3dp.com/2/what-is-cnc-milling-simply-explained/>
- <https://www.thomasnet.com/articles/custom-manufacturing-fabricating/understanding-cnc-milling/>
- <https://www.ndd.com.tw/en/ndd-news/blog/181-cnc-turning-operations>

Quiz

Question #One

#1. List the Four main CNC Machining Operations.

Answer

Face Milling

Plain Milling

Angular Milling

Form Milling

Question #Two

#2. List the Five basic CNC Turning Operations.

Answer

Taper Turning

Spherical Turning

Facing

Parting

Grooving