Course Code : RME 3212
Course Name : Manufacturing Process with CNC Programming Lab

Experiment no : 06
Experiment name : CNC Milling operation

Group no : 06
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Objective: To perform milling operation on a workpiece using a milling machine and CNC code.

Theory: Utilizing computerized controls and revolving cutting tools, CNC milling removes material from the workpiece to create a finished product that meets the required specifications. This process can be used on workpieces made with a variety of materials, including plastic, metal, wood and glass.

Several different processes can be performed with such a machine, including but not exclusive to:

Mechanical

Electrical

Chemical

Thermal

CNC milling falls under the category of a mechanical process, since cutting and drilling is powered mechanically, which follows a program, with no manual operation required.

The following step by step process illustrates how a CNC milling machine works.

1. The CNC program controls the actions of the machine.
2. The operator prepares the machine by setting up the worktable and the workpiece holding device, and attaching the milling tools and machine spindle.
3. Before the milling operation starts, a simulation is run on the computer/ peripheral device interface to ensure that the code works properly.
4. The operator observes the process to ensure that things go smoothly.

This cutting tool can rotate in various directions and along multiple axes. It is capable of creating many different shapes, holes and any other impression the part requires. Milling is often used to add finishing details to a workpiece that has already been machined, but it can also be used to shape a piece of raw material from beginning to end.

Whether the material has been previously machined or not, a milling machine will gradually chip away at the material to create the desired shape. As the process

goes on, it becomes more accurate and precise, so the finished part is within the right specifications.

Equipment: CNC Milling Machine, Workpiece.

Procedure: 1. A workpiece was selected for the milling operation.
2. The milling machine was set up properly with the proper worktable, milling tool, spindle setup etc.
3. CNC Code for the operation was written using G Code.
4. A simulation was run using the computer to ensure that the code performs the desired actions.
5. The milling operation was conducted using the milling machine, the actions of which were determined by the G Code provided.
6. Appropriate safety measures were taken while carrying out the operation.
7. After the process was completed, the workpiece was removed from the worktable. Chip was removed from the milling machine/ workpiece to ensure a smooth finishing.
G Code for the milling operation:
```
G00 G54 X0 Y0 Z0
G01 Z-3.5 F50
G01 Y-55
G01 Y00
G01 X9
G02 X9 Y-27 R15
G01 X00
G01 X25 Y-55
G00 G54 X0 Y0 Z0
G01 X90 F2000
G01 X-27.5
G01 X110
G01 X90
G01 Y-55
G01 X120
G90 G80 G40 G49 G21
G00 G54 X0 Y0 Z0
G01 Z-3.5 F50
G01 Y-55
```

Result: This is the workpiece after the milling operation was completed:

Discussion: The experiment was conducted smoothly without any issues. We selected an appropriate workpiece for milling, simulated the G code before starting the operation to ensure that it works properly, took proper safety and maintenance measures and removed chips/ rough edges after the operation was completed.
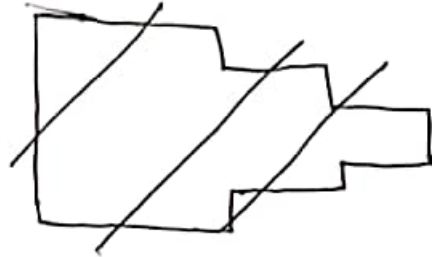
Reference: 1. https://www.uti.edu/blog/cnc/milling#:~:text=works%20and%20more.-,What%20Is%20CNC%20Milling%3F,%2C%20metal%2C%20wood%20and%20 glass.

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