ME209 PRINCIPLES OF MANUFACTURING PROCESSES

Sharpen the Pencil

INTRODUCTION

The objective of this project is to design and manufacture a sharpened pencil using the CNC milling center. This challenge combines engineering, mathematics, and working on a CNC milling machine to sharpen a pencil. Our aim is to start with a brand new, unsharpened pencil and utilize the CNC milling center to carve out the perfect conical tip. This report outlines the design considerations, choice of tool, design of tool path, and process parameters involved in achieving this goal.

DESIGN CONSIDERATIONS

Choosing the design of the pencil was the first challenge we faced, and had to figure out what design would give out the best results. After drilling on it, we went with a circular faced 7mm diameter pencil. The design of the tool path we choose is the contour path. Following the contour of the pencil's surface ensures consistent material removal and uniform shaping of the conical tip. Using this method, the tool follows the shape of the pencil closely, thus helping to keep the sharpened tip's size and curve consistent. The contour path minimizes tool engagement and reduces the likelihood of excessive wear on the cutting edges of the tool, thereby increasing the life-capacity of the tool.

CHOICE OF PROCESS PARAMETERS

The choice of process parameters in the CNC machining is crucial for achieving desired outcomes. The tool we choose is 5mm Bull Nose End Mill as it offers a balance between size and precision. It is large enough to efficiently remove material from the pencil's tip while still allowing for intricate detailing and fine adjustments. This size ensures that the milling process can be conducted with precision, resulting in a well-defined and conical tip.

PROCESS

- The process began by creating a CAD model of a conically sharpened pencil with 190 mm length and 7mm diameter.
- The CAD design with .ipt extension was saved and transferred to the CNC milling machine.
- After selecting the cutting tool and the design of the tool path, we generated the G and M-codes .
- Once the code is generated, using the Win-cp software, the code is then transferred to the milling machine.
- Setting the offset of x,y, and z-axis to be zero, we first did a dry-run, to test whether the code is working correctly.
- Finally, we did a reset and cycle-start to get our desired sharpened pencil.

LEARNING FROM THE OUTCOME

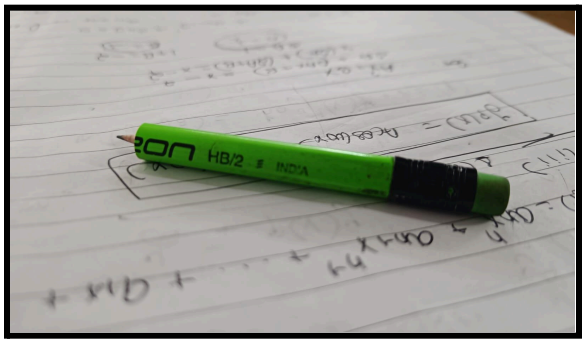
There are several learning outcomes which we came across during the whole process.

- We explored the creative application of CNC technology beyond traditional manufacturing processes, recognizing its potential for unconventional tasks like pencil sharpening.
- The most important learning outcome is that the pencil has a cylindrical structure, and we cannot get good accuracy using a milling machine. This challenge is well-suited to do on a turning machine.
- Through experimentation and optimization, we developed an understanding of the importance of precision and accuracy in CNC machining processes, as choosing a bad offset during the procedure on the milling machine would result in a nonuniformly sharpened pencil.

REFERENCES

[1] Destination_Centauri, “CNC-Lathe machine programmed to sharpen worker’s pencil (when boss is away).,” Apr. 22, 2022. https://www.reddit.com/r/oddlysatisfying/comments/u9lq97/cnclathe_machine_programmed_to_sharpen_workers/ (accessed Apr. 13, 2024).

PHOTOS OF THE CHALLENGE DONE



PEER REVIEW GRADES

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