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Design and Fabrication of Die Using CNC-Milling Machine

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ABSTRACT

Injection molding is considered to be one of the most prominent process for mass production of plastic products the object molded can be depend on the selection of proper mold and behavior of polymeric material in injection moulding process .The injection molding machine melts and plasticize the moulding material inside the heating cylinders and inject this into the mould to create the product . In this project the stool leg bush dye is designed and modeled for the required dimensions by using AUTO CAD NX Software .By using CNC milling simulator ,the dye simulation work is done using NC Program .The dye is manufactured by CNC milling machine .The stool leg bush is manufactured by injection moulding .This project presents a step by step guide on the use of reverse engineering in designing and manufacturing a dye for plastic injection moulding of a keychain.

KEYWORDS : Injection Moulding ,Polumeric Material ,AUTOCAD NX Software ,Stool Leg Bush ,Reverse Engineering.

INTRODUCTION

INJECTION MOULDING

The injection machine is a machine that melts plasticize the molding material inside the heating cylinder and inject this into the mold tool to create the molded product by solidifying inside it. The injection machine is constructed of a mold clamping device that plasticize and inject the molding material. There are several types in the injection machine, and the difference is made by how these devices are arranged , but time and look for the injection time when the weight of molded became a certain amount and stop changing.

Figure 1: Injection Moulding

CNC MACHINE

CNC machining is the most common subtractive manufacturing technology today and a hugely flexible and robust way to produce custom metal and plastic parts. Using CAD models, CNC machines precisely remove material from a solid block with a variety of cutting tools.

Overall, CNC machining produces parts with tight tolerances and impressive material properties. It's suitable for single jobs and low-to-medium volume production (up to 1,000 parts), due to its high repeatability. However, it does come with more design restrictions than 3D printing, thanks in part to the subtractive nature of the technology.

Figure 2 :CNC MACHINES

PRODUCT DESIGN

A product was needed for the development of this project. A souvenir was created to demonstrate the design concepts, functions and the applications of 3D CAD systems. This chapter presents the souvenir design process and the final product.

A product was needed for this project. This product had to have the features to demonstrate the applications of computer-aided technologies in mold design, analysis, and manufacturing. The product also had to be a plastic component in order to integrate plastic injection molding techniques. It was also important to come up with a product that would motivate the learning spirit of the students. This led to the idea of producing a souvenir. The souvenir was expected to motivate Engineering and Technology students into learning mould design and manufacturing using CAD/CAM systems, moulding process analysis and simulation, CNC machining and injection molding techniques. As the souvenir was for students the cost became an important issue. The first aim of the project was to look for an adequate material on the market. After several discussions and comparisons, a decision was made to use recycled plastics as the Institute has this type of material available. Following the design requirements, the early stage of the project came out with a number of ideas based on some market research. There were three designs to choose from. Following paragraphs will show these designs and the advantages of each design as well as the final selection.

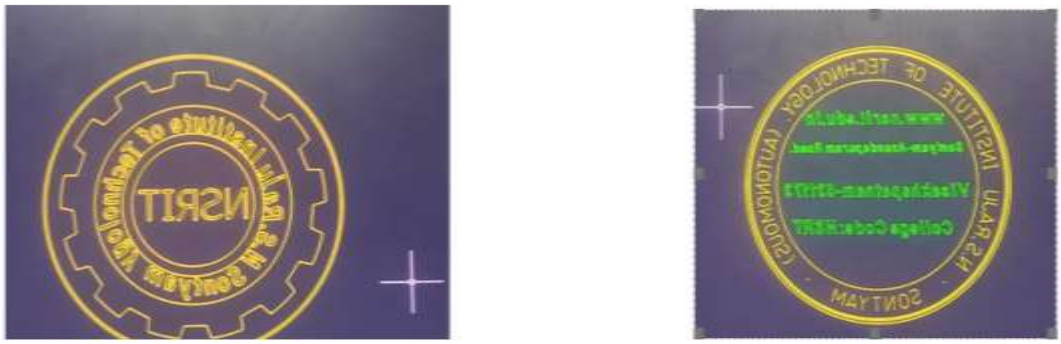

Figure 3 : Die Model Design in AUTOCAD

MATERIALS MACHINED UNDER THE CNC MACHINE

1. BRASS

2. MILD STEEL

1. PROPERTIES OF BRASS

1. Brass often has a bright gold appearance, however, it can also be reddish- gold or silvery-white. A higher percentage of copper yields a rosy tone, while more zinc makes the alloy appear silver.

2. Brass has higher malleability than either bronze or zinc.

3. Brass has desirable acoustic properties appropriate for use in musical instruments.

4. The metal exhibits low friction.

5. Brass is a soft metal that may be used in cases when a low chance of sparking is necessary.

6. The alloy has a relatively low melting point.

7. It's a good conductor of heat.

8. Brass resists corrosion, including galvanic corrosion from saltwater.

9. Brass is easy to cast.

10. Brass is not ferromagnetic. Among other things, this makes it easier to separate from other metals for recycling.

PROPERTIES OF MILD STEEL

1. High tensile strength.

2. High impact strength.

3. Good ductility and weldability.

4. A magnetic metal due to its ferrite content.

5. Good malleability with cold-forming possibilities.

6. Not suitable for heat treatment to improve properties

OPERATIONS PERFORMED IN CNC MACHINE INTERNAL OPERATION

1. Drilling

In this process, a drill enters the workpiece axially through the end of the workpiece and cuts a hole with a diameter equal to that of the cutting tool.

b. Boring

In this process, the tap enters the workpiece and cuts internal threads into a previously drilled hole.

OPERATIONS PERFORMED IN CNC MACHINE EXTERNAL OPERATIONS

1. Turning

Turning is perhaps the most basic operation a lathe performs. In this process, a single-point cutting tool moves axially, along the side of the workpiece to remove material; this forms different exterior features such as steps, chamfers, and tapers. Such features are typically machined with many passes with small depth of cut until the needed diameter has been achieved.

2. Facing

In this process, a single-point tool moves radially along the end of the workpiece. This removes a thin layer of material to provide a smooth, flat surface. The depth of the face is very small, so facing can often be used as a precision finishing process.

3. Thread Cutting

If tapping is the method for threading the interior of the part, threading is the inverse. In this process, a single-point threading tool (usually with a 60-degree pointed nose) moves along the side of the workpiece to cut threads into the outer surface. The threads can be cut to a specified length and pitch and may require multiple passes to ensure the desired size or dimension**.**

4. Grooving and Cut-off:

In grooving, a single-point cutting tool moves radially into the side of the workpiece to cut a groove equal to the width of the tool. When wider grooves or when grooves of various geometries are needed, multiple passes are made. The cut-off process is similar workpiece to cut the part from the stock.

In addition to these static tool operations, modern CNC lathes utilize live tools, which are driven by the turret. With a live tool, you can perform secondary operations such as drilling, tapping or milling .

INJECTION MOLDING PROCESS

Injection moulding is the most traditional plastic parts manufacturing procedure. Using injection moulding, a large range of items are made, varying in scale, complexity and implementation. Hot runner is better than cold runner but is seldom utilized due to high cost and difficulty. Every substance needs a complicated set of parameters such as injection temperature, injection pressure, flow rate, mould temperature, ejection temperature, cooling rate and cycle time. Improper set of parameters leads to many flow lines, burn marks, warping, vacuum voids / air pockets, sink openings, weld lines, jetting. Few defects, including discoloration, plastic use and delamination storage. Quick shots and flash triggers faulty construction or fix. These criteria include process optimization and defect-removal collection. The impact of these criteria on moulding process and recommendations to generate defect-free components needs more study.

CONCLUSION

Hence, we have successfully designed and manufactured a plastic injection molding die to produce plastic keychains with the help of reverse engineering approach. We could also establish a stable relationship between reverse engineering and rapid prototyping processes with a few more adjustments and process enhancements. We can also conclude from this research that manufacturing of a plastic injection molding die is possible by using reverse engineering approach. More accurate dimensions of the die could be obtained by using Laser Scanning instead of CNC.

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