THE APPLICATION OF CAM SYSTEM AS A TOOL FOR THE PRODUCTION OF SELECTED PARTS FOR A NEW GENERATION OF EXTRUDER

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Abstract
The paper describes the process of manufacturing selected metal parts for a new generation of extruders. CNC machines were used to produce the parts of the extruder and a suitable selection of strategies to produce parts was made. SolidCAM and CATIA systems were used, where lathe and milling operations were programmed to produce extruder parts.
Key words: plastics extrusion, extruder parts, CNC program, lathe and milling operations

1. INTRODUCTION

In modern production of polymer products extruders occupy one of the most important places. Plastics extrusion is a continuous high-volume manufacturing process, in which raw plastic is melted and formed into a continuous profile. With the help of extruders things like pipe, sheet, plastic films, profile strip insulation for cables and others are produced. In general, processing of polymers is one of the fastest developing directions of the industry nowadays.

Today´s companies operate in a wide input of automatization. It is meant that workload has increased significantly in the technical aspects of preparation production systems compared the manufacturing workload. It is hard to imagine the production on a large scale and quality assurance requirements profitable without the use of computers. Today capabilities of CAD/CAM applications are the result of increased quality, speed, and graphics capabilities of systems, based on modern microprocessors. [1]

The usage of CAD/CAM is the most effective solution for the implementation of technological preparation of production of complex shaped parts. [2,3]. CAD/CAM systems permit significant improvements in milling and turning operations, which can be reflected in reduced machining time and minor finishing operations. On the appropriate manipulation of a CAD/CAM system relies much of the success of the machining procedure [4].

2. PRODUCTION OF EXTRUDER PARTS

This article describes the manufacturing process of selected parts for a new generation extruder. Some simple part shapes were programmed directly on the machine in the Sinumerik control system, but for complex shapes the CAM system SolidCAM or CATIA was used. Machining of parts was performed on the following machines: DMG MORI ECOMILL 50, DMG MORI ECOTURN 510 CNC turning milling center, Wire cutting machine Accutech AU 500l.

2.1 Production of the Barrel part

CAD model in Solidworks of the segment Barrel is shown in Fig.1. The material of this part was 18 G2A (1.0562). To produce of the segment of Barrel three clamping positions were used. For the programming, the CAM system SolidCAM was used.

Manufacturing process of barrel:

- ***The first clamping*** - turning milling center

1. Face turning finishing, tool Sandvik DCLNL 2525M 12
2. Turning cylindrical face
3. Grooving tool, Fig.2, TGSU 35 6 IQ ISCAR, tool width 6,3 mm
4. Central hole, Fig.2, drilling tool diameter 20 mm

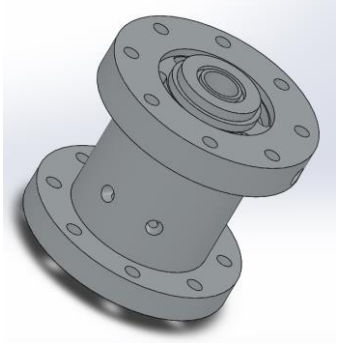


Fig. 1 CAD model of Barrel part

Barrel part after grooving operation and drilling central hole D 20 mm turning central hole is shown in Fig. 2.

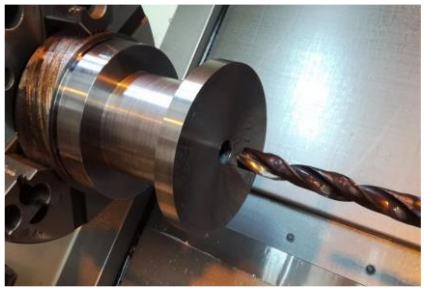


Fig. 2 Part after turning - central hole

After drilling of central hole followed holes drilling 8 x diameter 8 mm on the first face surface and the holes with diameter 8,5 mm on the second face surface (Fig.3). Guide holes from the previous operation were used to drill the second holes.

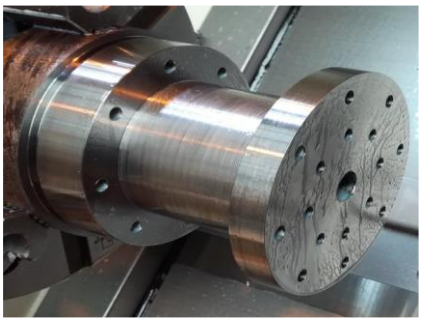
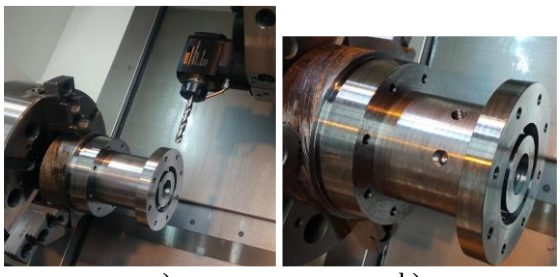


Fig. 3 Guide holes - final holes

After holes circle groove milling was created and then followed the milling of three pockets. At the end threads M10 were created.

In this first clamping on the turning milling center was created the last operations as radial holes drilling (Fig.4a) and threads 2 x G ¼ and radial hole drilling (Fig.4b) with thread M 12x1.



a) b)

Fig. 4 Radial holes drilling (a), threads creation (b)

- ***The second clamping*** – 5 axis CNC milling machine

1. Face milling (Fig. 5), tool diameter 63 mm
2. Slot roughing, tool diameter 20 mm
3. Face finishing, tool monolit diameter 16 mm
4. Drilling holes, diameter 11 mm
5. Circular groove, to 6 mm depth, tool monolit diameter 5 mm
6. Groove width 3 mm milling, tool monolit diameter 5 mm

Fig. 5 Part clamping and face milling

After pockets milling (Fig. 6) were holes drilling 8 x Ø 8mm. Followed the rotation to required angle and drilling the radial holes and threads ½ 20 UNF.

Fig. 6 Part after circular groove and pockets milling

- ***The third clamping*** – wire cutting machine.

We had to use a wire cutting machine to get a hole with the required size and accuracy. A method of clamping the part and hole cutting process is shown in Fig. 7.

The final shape of the part with the required dimension after third clamping is shown in Fig. 8.

Fig. 7 Part clamping on wire machine and hole cutting

Fig. 8 Final shape of the Barrel part

2.2 Production of the Body part

The material of this part was 40HM (1.7225). The CAD model in Solidworks of the Body segment is shown in Fig. 9.

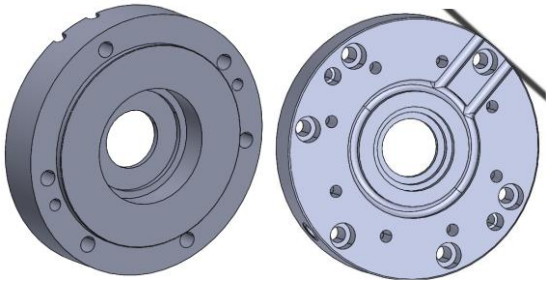
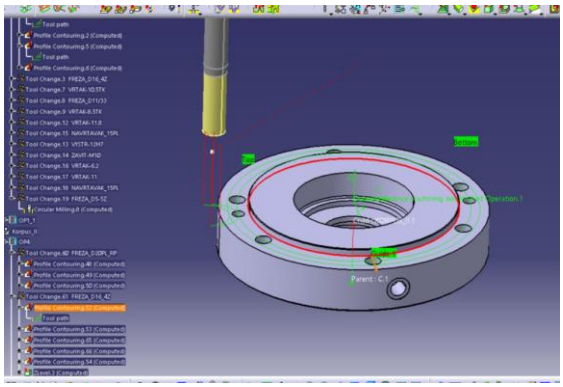


Fig. 9 CAD model of the Body part

CAM system CATIA and 5-axis CNC milling machine was used for producing of this segment. We used two clamping positions on different machines.

Tool path of the tool was generated in CAM system CATIA. At the top of the surface zero point was define and were selected necessary of the tools for the milling of the part. Milling of the outside contour and the inside circle pocket shows Fig.10.



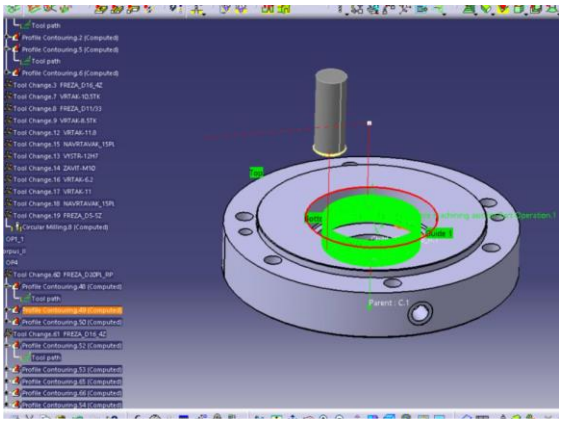


Fig.10 Outside milling contour and inside circle pocket milling of the Body part

Manufacturing process of the Body part:

1. Slot roughing, Tool monolit diameter Ø 5mm
2. Slot semifinish, Tool monolit diameter Ø 4mm
3. Slot finish, Tool ball nose monolit diameter Ø 4mm
4. Pockets milling, Tool monolit diameter Ø 16mm
5. Chamfers of pockets
6. Holes drilling, Tool drill diameter Ø 8,5 mm
7. Chamfers
8. Threads M10
9. Holes drilling, Tool drill diameter Ø 6,8 mm
10. Chamfers
11. Threads 5 x M8
12. Radial hole and thread M12 x 1

Final shape of the Body part is shown in Fig.11.

Fig. 11 The final shape of the Body part

2.3 Production of the Top plate and Bottom plate parts

The material of this parts was 40HM (1.7225). 3D CAD model in Solidworks of the top plate and bottom plate is shown in Fig. 12.

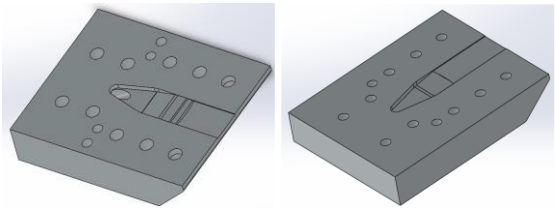


Fig. 12 CAD model of Top plate and Bottom plate parts

Top plate and Bottom plate were made by 5 axis milling machine.

Manufacturing process of the Top plate:

1. Milling outside contour, left allowance 0,2 mm for finishing
2. Holes and threads 4x M6, 2x M10, M12x1
3. Process of hardening HRC 32
4. Flat surface grinding
5. Finishing outside contour on finally dimensions
6. Shape milling Ø 8 mm
7. Finishing flatness surfaces Ø 2 mm
8. Finishing edges and rest surfaces, ball nose Ø 1 mm
9. Rotation to required angle 30° - milling by tool of diameter 5 mm and holes drilling
10. Finishing holes - Ø 8H7

Before produce of the parts some simulations in CAM system CATIA were made. Some pictures from simulations are shown in Fig. 13.

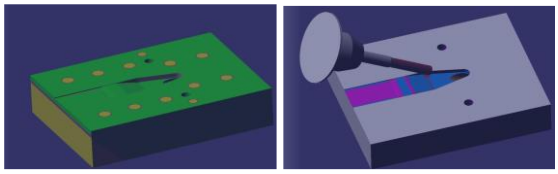


Fig. 13 Part production simulation

The same technological process was made also for the Bottom plate, where is not angle defined hole and shaped surface. The final shapes of the plates are shown in Fig.14.

Fig. 14 Final shapes of the plates

CONCLUSION

The paper deals with the application of CAD/CAM systems in the production of selected parts for a new generation extruder. The main objective of the authors was practically implemented CAD/CAM systems and optimize the manufacturing process of three parts from the beginning to their production. Various CNC machines were used in the production of these parts. In the production process, it was necessary to consider the method of clamping individual parts, the choice of suitable strategies for milling, turning, the choice of suitable tools and cutting conditions the required material and shape. The programs creation was based on drawing documentation and CAD models.

The paper describes the production of three parts from many other parts that were made for a new generation extruder within the solution of the NewEx project.

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