DESIGN AND REALIZATION MASSIVE ELECTRODES FOR ELECTRIC DISCHARGE MACHINING WITH „SOLID EDGE” APPLICATION

Iulian STĂNĂȘEL, Traian BUIDOȘ, Florin BLAGA, Flavius ARDELEAN
University of Oradea, Faculty of Managerial and Technological Engineering

Abstract: The paper presents a design and realization method of massive electrodes tool to achieve the active area of plastic injection molds, from the 3D model of the parts of plastic to be gained through injection. In order to obtain the solid model of the electrode which processes the mould of the outer surface of the presented part, it is used the module “Electrode design” which is included in Solid Edge. Taking into account that the electrode is bordered by complex surfaces, it is required processing on CNC machine tools, the piece-program being gained through running a CAM applications.

Keywords: electrode design, complex surface

1. INTRODUCTION

In making dies and molds and restoring processing by electric erosion has become widespread, since in many cases, particularly in processing complex parts the time of processing by erosion is considerably less than if processing by milling. In most cases it is realized a roughing by machining operation which has the purpose to obtain the hole in the active plate which allows movement of dielectric during processing.

This is highlighted in particular at the dies with cavities having a very large volume of eroded material. In this case it is machined first by a process of milling machines, untreated condition of the material, leaving it, depending on the complexity of form to be completed, added processing of 0.3-1.5 mm by electric erosion processing.

After this process by cutting the material, it is made the heat treatment and then a finishing by grinding, following processing by electric erosion.

Using electric erosion to the execution process of dies and molds enable their processing in conditions of growth productivity, both before and after heat treatment.

Processing dies and molds after the operation of heat treatment leads to the elimination of additional operations of grinding to remove thermal deformations caused by heat treatment. After heat treatment and correct reference surface, is made by EDM roughing and finishing usually with the active plate assembled.

Instead of the processing of holes, which are not allowed conical surfaces, the processing of cutting dies and mold plates shall be implemented to achieve a taper angle necessary to evacuate parts stampings.

Establish the technological process parameters is based both on accuracy and surface roughness of cavity to be processed, and the surface area attacked by electrode-tool, aiming at achieving the best possible productivity.

Number of passes to the processing of dies and molds and also of electrode – tool is given by the cavity surface quality to be obtained (fit for purpose).

To ensure high precision of the profile after the last processing is also making a finishing with the same electrode-tool, but with fine electrical parameters.

Establishment of proper technologies and processing parameters make the electric erosion processing of dies and molds to get a large area of application:

The main applications of electric erosion processing is:
- molds for plastics injection;
- hot forming dies;
- casting;
- dies of die-cast;
- carbide cutting tools;

Electrodes-tool for processing dies and molds are characterized by the fact that their generally form must joint with the cavity shape which must be obtained.

Since the implementation of dies and molds, electrode-tool wear can not be compensated by their length, the cavity should be brought to final form through a number of electrode-tool, appropriately sized operations roughing, and finishing.

In terms of materials which are made the electrodes, they may include: copper, graphite, brass, wolfram, aluminum alloys. Procedures for obtaining electrodes-tool are varied. Can be mentioned processing by: cutting, forging, hot extrusion, casting, sintering metal, electroplating. From these processes, cutting machining knows growing expansion especially in actually stage of CAD-CAM technology.

2. ELECTRODE DESIGN

The paper presents a design and realization method of massive electrodes tool to achieve the active area of plastic injection molds, from the 3D model of the parts of plastic to be gained through injection.

You can create electrodes inside Solid Edge with Electrode Design module. The electrodes can be created using the electrode application's commands or using another application, which can be Solid Edge itself or an external application. You can choose to create multiple copies of electrodes or just their fronts, with or without symmetry, and specify different positions for the same electrode. You can also join several electrodes on the same base or create a compound electrode. You have absolute control on the output drawings for NC machining and for the erosion procedure.

This paper presents the steps in order to obtain the solid model of the electrode which processes the mould of the outer surface of the part (lid) presented in Figure 1 realized by a material with coefficient of contraction 4%.

By the analysis of this piece can be seen that it is bounded by a complex surface which makes difficulty the cutting processing, even with the current CAD-CAM technology, due to the necessity of surface quality.

In order to obtain the solid model of the electrode, first it is necessary to be created mold cavity in which is realized the work-piece. This is achieved by using mode "Mold design" also included in Solid Edge. To make the mold cavity in the first phase is necessary to specify the 3D model of plastic desired piece. Then is specified the surface where the piece is mounted on, in the cavity that must be designed (figure 2).

After entering data for materials and plan the separation of mold results the two pills which
formed the nest component of mold cavity and core (Figure 3).

The electrode design starts by opening in Electrode design module (Figure 4).

The application's toolbar will have 9 different commands and will run in the Assembly environment of Solid Edge. A designed electrode can be a simple electrode or a container of several other electrodes joined together by a base plate. A simple electrode corresponds to an electrode body with an optional base attached to its top face. An electrode body consists of the front shell and a protrusion of a bounding geometry to a flat face, the electrode body's top face.

Starts a new Electrode Design session begin by Select Plate/Insert command will let you import plates or inserts into the Electrode Design work area. The part is imported in its original orientation. In most cases it is necessary to specify the surface orientation of the mold plate which is designed the electrode for, so that its Z axis is vertical (Figure 5).

The next step consists in specifying the electrode parameters by introducing them in a dialog box (Figure 6).
The significance of the fields appeared in the dialog box is.
Type - Sets the default method to compute the electrode’s body height
Height - Set the default height of the electrode body. This value is used when the height computation type is By Height.
Top Z - Set the default Z coordinate of the electrode body. This value is used when the height computation type is By Coord.
Draft - Sets the default draft angle to apply to the electrode body walls.
Size - Set the minimum size of the electrode body profile. For a rectangular electrode body, this value represents both its X and Y dimensions. For a circular electrode body, this value represents its diameter.
Offset - When a selected front is larger than the minimum electrode body size, either in X or Y, the new electrode body size will stretch to the same size as the front's bounding box, with the addition of an offset on each size. You can set that offset here.
Base by Offset - Choose to use the Base by Offset method by default to compute the electrode base size. If this option is turned off, then the direct sizing method will be used.
Size - Set the minimum size of the electrode base. For a rectangular electrode base, this value represents both its X and Y dimensions. For a circular electrode base, this value represents its diameter.
Offset - Set a minimum value for the computation of the electrode base size using an offset from the electrode body. This value represents the offset to use in all necessary dimensions.
Height - Set the default electrode base height.
Material - Set the default material when building new electrodes.
Simple Electrode Name - Set the name of all simple electrodes, displayed in the Edge Bar and in output drawings.

3. ELECTRODE MANUFACTURING

Taking into account that the electrode is bordered by complex surfaces, it is required processing on CNC machine tools, the piece-program being gained through running a CAM applications.

In the present case it was used NX Machining module of Solid Edge (Fig. 9).
The processing of electrode was made in two steps, one pass of roughing and a finishing one. CNC program required multiple elements. First of all it is necessary to set the semi-piece (Figure 10).

They are established the cutting tools and their parameters. It was considered that the processing is done in two phases roughing and finishing using different tools. For roughing it was used a cylindrical cutter (Figure 11), and for finishing, a cutter with a round head.

Taking into account that is processed a complex area, the value of depth crossing is important. As less it is, the resulted surface will be closer to the final form surface. For roughing the passer was established at a depth of 0.5mm (Figure 12), and 0.1 mm for finishing.

It was established the size of processing adjustment for the next finishing phase (Figure 13).

After choosing cutting schemes as recommended in the literature result the processing programs for roughing and finishing (Figure 14).

In order to detect the errors in the program and any collisions it is simulated both roughing and finish machining programs (Figure 15).
Figure 15.
After simulating the processing, it is passed to postprocessing programs to get the code which must be implemented on the CNC machine to manufacture (Figure 16)

CONCLUSIONS:

Extension ratio and diversity of plastic products makes processing by electric erosion of dies and molds to get a large usefulness.

Establishing the technological parameters of processing is based on accuracy and surface roughness of cavity to be processed, and the surface area attacked by electrode-tool as well, aiming to achieve the best possible productivity.

Taking electric erosion to the execution process dies and molds allow their processing in conditions of increasing productivity, both before and after heat treatment tempering.

Since the implementation of dies and molds, electrode-tools wear can be compensated by their length, the cavity should be brought to final form through a number of electrode-tools, appropriately sized corresponding to roughing, and finishing operations.

Procedures for obtaining electrode-tools are varied, but of these processes, known machining by cutting records an expansion, especially in actual stage of CAD-CAM technologies.

The paper presents a modern method of design and execution of massive electrodes in order to realize the active area of plastic injection molds using CAD-CAM technology, based on the 3D model of the parts of plastic which must be obtained through injection.

REFERENCES
[5] Unigraphics NX5 help