

ABOUT A MOULD CAVITY MANUFACTURING USING SOLID CAM

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Abstract: The manufacturing process of the mould cavity implies, in almost all difficult cases, a sustained technological effort, because of the complex shape of the cavity.

By combining the classical cutting proceedings with the EDM methods - which are the most used in practice - require higher manufacturing costs, resulting in an expensive final product.

By means of the CAM soft such as Solid CAM, Master CAM etc., we can program and execute complex surfaces by milling cutting. In this way the designing, manufacturing of the electrode and the EDM processes of the cavity will be excluded.

1. MOULD CAVITY CONSTRUCTION

Mould cavity, the place where the new piece will be formed, is perhaps the most important component of a mould [1], [2], [3]. Manufacturing the mould cavity requires elaborate and difficult procedures and also a diverse technological itinerary, even if it is realized directly on forming plate or even if it has a separate part for the mould cavity.

In most cases, the complexity of the mould cavity shape imposes various technologies, from mechanical working to EDM. EDM implies high costs of the final product, because of the additional processing (design and manufacture of the electrodes). A combination between mechanical working and EDM could be a good choice for a piece to be manufactured.

In figure 1, the mould cavity which has to be realized can be observed.

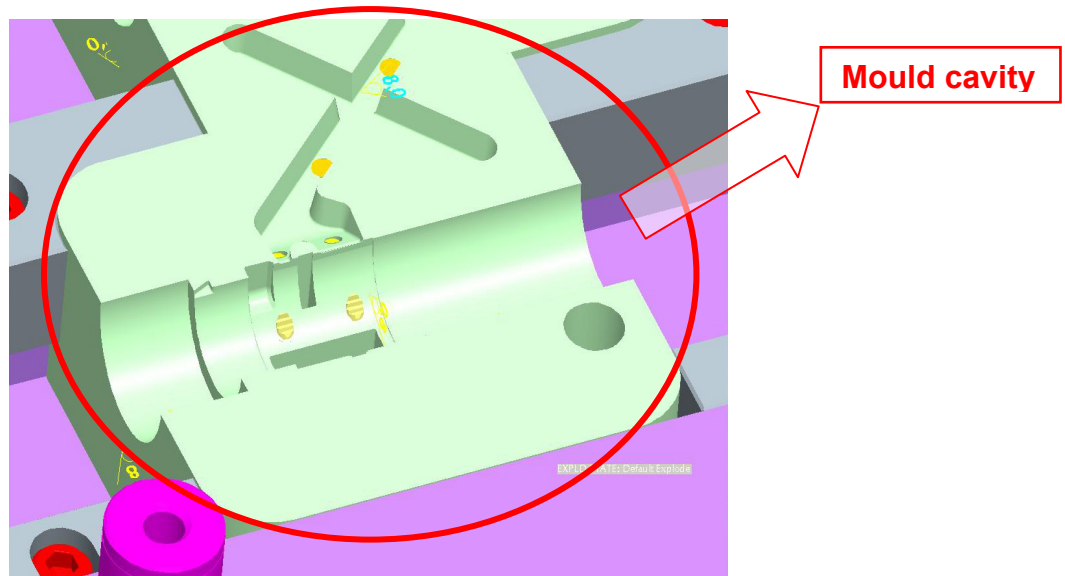


Fig. 1 Mould cavity

For the injection mould to work, it must have two longitudinal mould cores, which open when the injection mould opens, driven by two cylindrical fingers mounted on the fixed plate. These cores materialize the interior of the piece. Also, another three transversal cores materialize holes in the part.

After a short analysis of the mould cavity, we can observe that the centre of the part can be removed by applying the wire cutting procedure. The rest of the part can be made by mechanical working on a CNC machine. The rays on the part allow us to choose the

machine work technologies, at least in the first step, where we have to remove most of the material.

However, before we make any decision on how the part should be executed, on what technology we should choose, we have to figure out what the costs are and how long it takes to be made. Manufacturing on the CNC machine is not always profitable if the machine tool is not highly efficient, the time for manufacturing takes longer if the electrodes for EDM will be used or if the processing implies expensive cutting tools etc.

If we chose the technology that implies manufacturing on a CNC machine tool then, using a CAM soft will be more than necessary due to its features: user friendly programming interface, easy to work even for a beginner, large range of operations to use with programming, possibility to generate a program for the CNC equipment etc.

Programming speed increases using CAM soft and also, the efficiency in manufacturing, due to the possibilities in choosing the best way to work.

2. MANUFACTURING OF THE MOULD CAVITY

For the mould cavity to be made, according with the design engineer's request, it is necessary to accomplish two steps [4]:

The *first step* implies making the mould cavity in 3D format according to the piece shape and characteristics. When designing the mould cavity, we have to consider the contraction which plastic part suffers inside the mould cavity after casting and cooling between injection times. In designing the mould, we can use different software's (Catia, Solid Works, Solid Edge, Pro Engineer etc).

After the mould was designed in 3D we can start, the *second step*, manufacturing its components (those components which are not standard). Standard parts will be ordered from the producers' catalogues. The mould cavity is the main part that defines the injection mould and it is manufactured by different methods: cutting work, EDM, laser work (especially for engraving) etc.

Before we can be able to start manufacturing the part by the help of SolidCAM we have to accomplish some aspect regarding the origin of the part, semi-product shape, tools library, working directory etc.

With all those conditions completed, we can start working on the part now according to an established technological itinerary. It is not necessary to follow that itinerary if there is a better idea. This technological itinerary could be changed during the manufacturing program without interference with the work previously done.

First operation is a roughing operation in which we want to remove a lot of material from the parts that remain after the wire cutting procedure (the mould cavity had a wire cutting operation before the cutting operations on the machine tool). The rough operation is presented in figure 2 and the piece can be seen after the wire cutting operation.

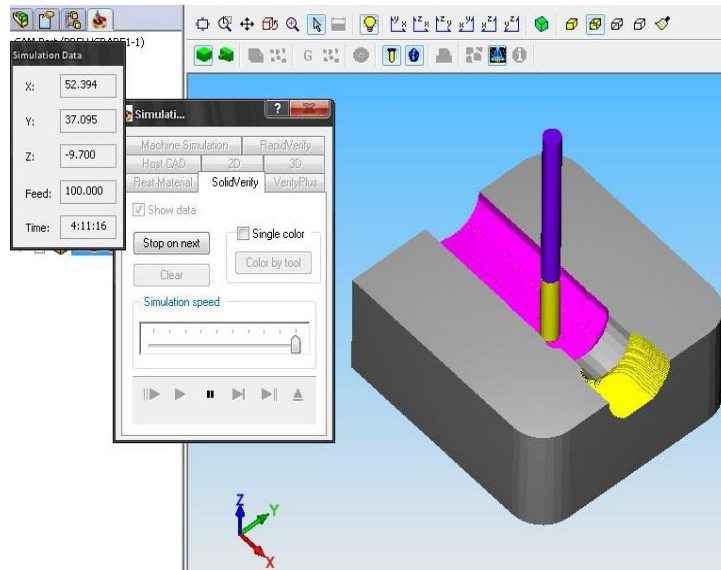


Fig. 2 Roughing of the mould cavity

Because of the complex shape of the part, we have to work with “3D milling” operation on roughing and also on finishing.

Some aspects from the manufacturing process in Solid CAM are shown in figure 3. A color spectrum (figure 3, d) shows us the tooling allowance on the part, differences between the final part and the part after the last operation.

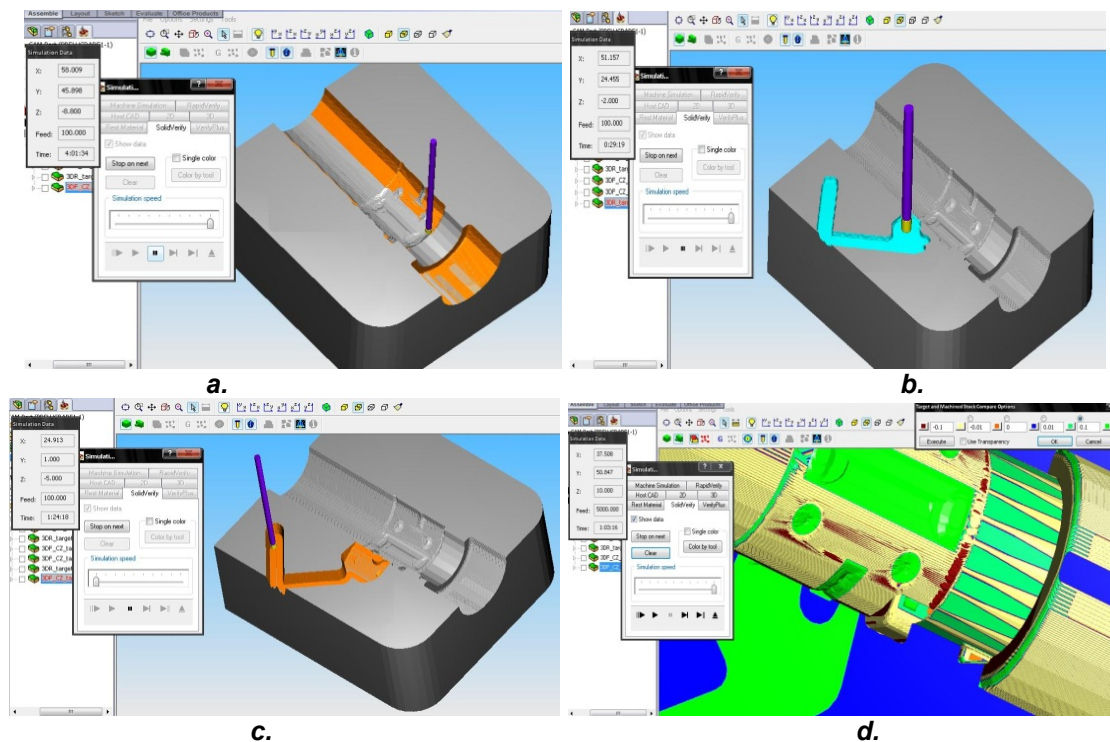


Fig. 3 Certain aspects from the manufacturing process [5]

Finishing of the middle surface it is shown in figure 3, a; the roughing (figure 3, b) and the finishing (figure 3, c) of the gate runner is shown above.

We don't have to make contour operations because the semi-product is at final quota. The holes for the ejector pins and for the cooling system will be made after the mould cavity processing was done by wire cutting at final quota.

The finishing operations are made with or without tooling allowance material, depending of the technology that was chosen. That means that if an electro-erosion operation for a smoother or a special surface is necessary, at the end of the processing operations, we have to let material for that.

3. CONCLUSIONS

Regardless of the processing types, using a CAM soft increases the programming speed and reduces the programming engineers mistakes, because of the "right on time" visualization of the part processing before it is even fixed on the machine tool table.

In our case, the cutting operations made on the mould cavity were made in the shortest interval possible, even if the complex shape of the part was exigent. We had an image of the part after every cutting operation we made.

Defining the material of the part (aluminum, middle steel etc.) allows us to have an image of the manufacturing time when the part will be on the machine tool.

Also, the main aspect is that we have the possibility to generate a program for the CNC equipment and the machine will process the part exactly like we have seen on the computer screen.

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