STUDY REGARDING THE INFLUENCE OF THE CAE SYSTEM ON THE PARTS PALSTIC QUALITY MANUFACTURED BY INJECTION

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Abstract: The scope fot this work is to present a modern solution to determinate the best parameters of an injection molding machine using an appropriate software witch simulate the process. Using the most important input data like: plastic material, surfaces of the cavity, injection location, characteristics of the injection molding machine and the most important quality criteria of the injection part, the C.A.E. program calculates the best parameters of the injection machine to obtain the best quality for the plastic part.

1. INTRODUCTION

Due to high complexity of machines and technical equipment of the recently years of the injection molding technique have determinate the conception of a great number of injection plastic parts which are more and more complex with a big variation of the thickness and very complex geometries forms and using more quality plastic materials. This tendency has determinate an unlimited growing of work complexity for part designer, mold designer, and molding engineers which needs to execute better plastic parts at the best cost-performance deal.

For example to determinate the best parameters for an injection molding machines using the classics methods, molding engineers needs to do a lot of numbers of molding parts and changes a lot of number of injection machine parameters to achieve at the best injection machine parameters.

This classic method has a lot of disadvantages like:a great lost of plastic material, more energy consummation, more time lost because they are a lot number of injection parameters which must be optimized, less efficiency of an injection molding machine because of the time lost without using in production the molding machine, needs of using a very high injection molding engineer specialist, necessity to redo all the work of optimization process for the best injection molding machine parameters when it needs to change one of the input date like other machine type or other plastic material or other injection condition.

These disadvantages can be avoid using CAE programs which can simulate the injection process which can be accurately determine based on the simulation results the best injection parameters for a plastic part using the chosen plastic material and the chosen injection molding machine during the design phase.

2. CASE STUDY

In the following we like to present an example of the procedure to determinate the best injection parameters for a molding machine for a plastic part molded at SC UAMT SA called fuse panel lid (fig.1.)

Because this plastic part needs to assembly with other plastic part, the quality criteria for which is necessary to determine the best injection parameters molding machine are: minimum warpage, minimum dimensional deviation, minimum sink mark.

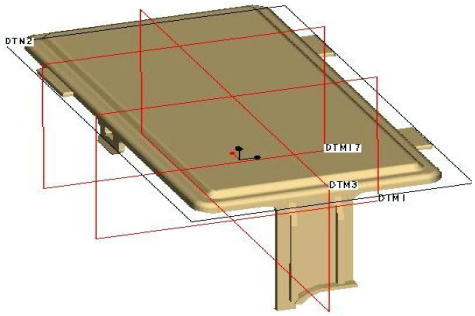

Fig.1.The plastic part chosen for study

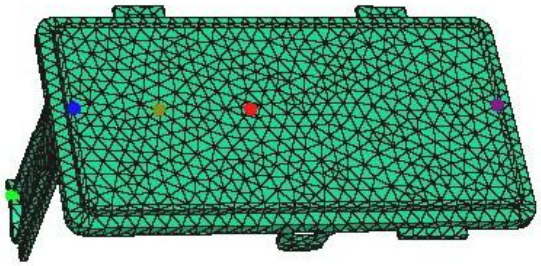

Fig.2. The mesh model used for simulation

The first step of the procedure for determination the best injection parameters of the molding machine are to import the cavity surfaces of the model for the plastic part into the simulation program and transformed then into a mesh model (fig. 2.)

The second step is to create the real condition for injection the plastic part like runner/gate system with the real size and location. For the plastic part *fuse panel lid* chosen for study the injection gate system is direct gate injection. (fig. 3.)

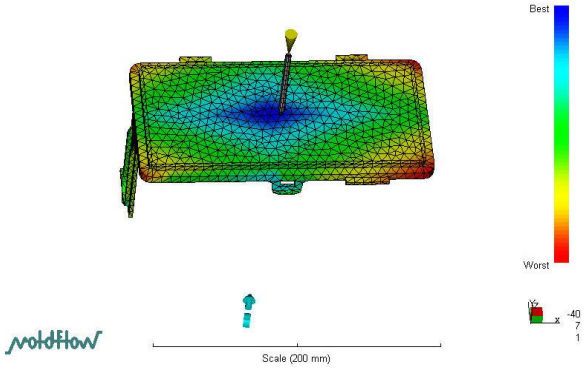

Fig.3. the plastic model with the real injection gate system.

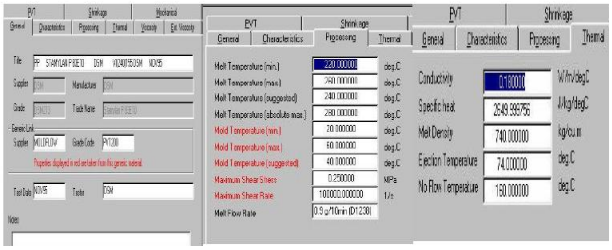

Fig.4. the specific date of the chosen plastic material

The third step is to choose the appropriate plastic material from the library of the simulation program which must be the same type and kind of material which is used for molding the plastic part. The most important injection characteristics are presented in (fig.4.)

The forth step is to choose the appropriate injection molding machine. For molding the plastic part *fuse panel lid* we have chouse the injection molding machine: ENGEL duo 500 presented in (fig.5.) with the principal characteristics presented in the table (tab.1.)

Fig.5. The injection molding machine usingfor molding the plastic part fuse panel lid

Nr. crt.	*Caracteristic name*	*Value*	*Units*
1	Clamping force	4600	KN
2	Clamping screw diameter	80	mm
3	Maximum injection pressure	1600	Bar
4	Maximum dosing course	330	mm
5	Maximum injection rate	420	cm^3/sec
6	Screw intensification factor	12	
7	Mximum rate/course steps	12	
8	Mximum pressire/time steps	12	

Tab.1. The principal caracteristique for the injection mol ding

The fifth step is to determine the best injection condition for the specific material and plastic part. The molding window analysis uses the part geometry, the selected material and the injection location as inputs for determining the optimum injection processing conditions for the part.

The best condition in the Molding Window results represents the position in 3-dimensional space where values for the injection time, mold temperature and melt temperature are optimal. To determine the best injection condition for the Mesh Model the program analysis considers the following aspects: process ability, inimum pressure: lower injection pressure produces lower shear rate and shear stress levels, geometric resistance The results of the best injection condition analysis are presented in fig.6.

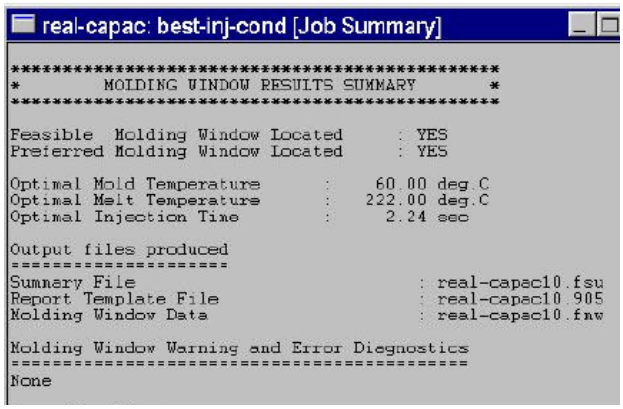

Fig.6. The results of the best condition analysis

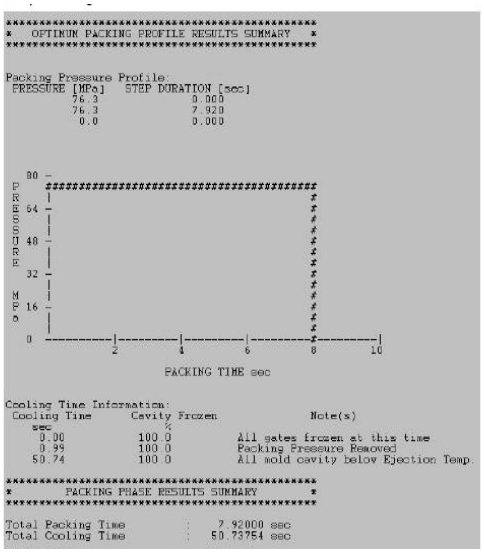

Fig7. The best packing parameters for the chosen injection molding machine.

Using the best injection condition date obtained before we can now proceed to the final step where we should running a full filling analysis with best injection processing condition for the chosen plastic material and using the chosen injection molding machine.

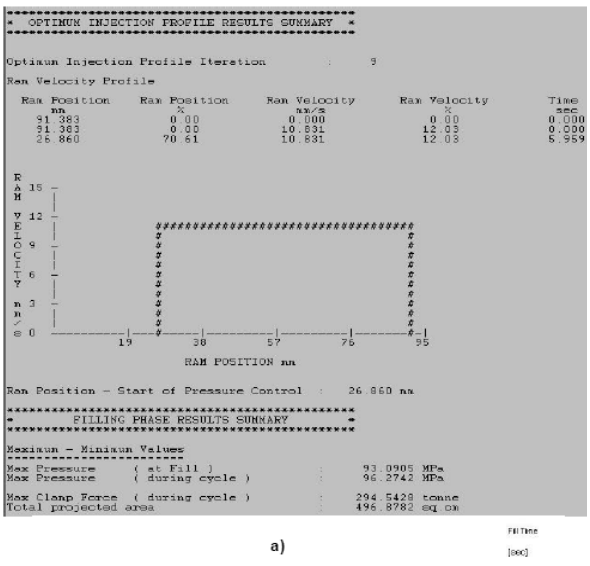

Fig.8a. The parameters of the injection stage for the chosen injection molding machine

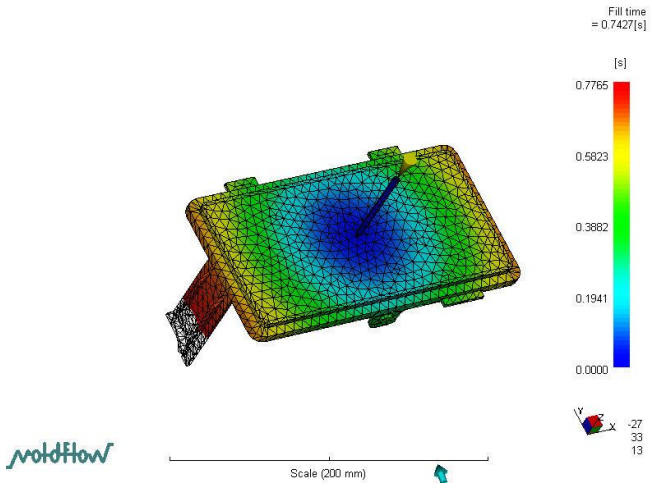

Fig.8b. The melt flow during filling the cavity for the model

The simulation program analysis provides results for the most important stages of the injection process which are:

1. filling stage;
2. packing stage;

The simulation of the packing stage provides all the parameters of the injection molding machine which are needs to be set for the packing stage (fig.7) like: maximum packing pressure, number of packing steps, minimum packing time, minimum cooling time maximum clamping force, shot weight, part weight

The simulation of the filling stage provides all the parameters of the injection molding machine which are needs to be set for the filing stage (fig.8.a) like: number of velocity steps, maximum injection pressure at filling, injection ram position, injection velocity, exact position for start the pressure control, injection time.

How the cavity of the mold model is filling by the melt flow during the filing stage (fig.8.b).

3. CONCLUSIONS

Based on researches from this paper we can find that CAE simulation programs are very efficient especially for technical parts of high complexity.

An optimum injection profile during filling stage and an optimum packing profile should minimize warpage and surface defects and maintained dimensional tolerance in the optimum profile. The purpose of the simulation program is to overcome molding problems predicted the optimum injection parameters in order to produce the best part quality at the minimal cost and more important these processing parameters can be set only for the chosen injection molding machine.

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