

AN EXPERT SYSTEM OF THE ESTIMATE TECHNOLOGY FOR DISPLAY MEANS

Park, Sang-bong¹

Abstract — An estimate technology for standard machining time focused on the large size TV set has been studied. Generally speaking, the estimate calculating work of mould is achieved by experienced engineers. However, at most mould manufacturing enterprises, there are frequent cases that they calculate by rule of thumb because they have neither established standardization nor have determined clear estimate method. As the result, in fact, it is natural that not only much time is wasted but also absolutely draw up and submit non-consistent quotation, which leads to raise major and minor quarrels with their clients continuously. Therefore, in order to remove such a problem point, in this study, the development and application of expert system is studied for estimate calculation at the mould manufacturing process. The application of the developed system to the working site has the advantage that even beginners can create better quoting result than experts. The developed system used visual BASIC language and SQL Data Base under Windows environment.

Index Terms — Estimate technology, Expert system, Machining time, Mould base, NC data

INTRODUCTION

The mould technology has been developing pretty rapidly as well as being in good harmony with the technical renovation of the 6T. And, this trend is expected to continue at an increasing tempo, while deepening the width and depth of its application even more. The rapid economical and social transition in recent years have changed the technologies of production and cost management in manufacturing sector remarkably. In particular, the mould manufacturing sector requires innovative changes in quality, cost and delivery and, accordingly, the improvements in technical development, productivity and reliability are on the way to meet the requirements. Also, the trade volume of moulds are increasing continuously and the various restrictions on international trading are strengthening more than ever before.

The countermeasure of the mould enterprises in this circumstance, unlike what had been in the past, is to submit more rational, rapid and objective data, and only a settlement of management technology, say of one stage more advanced, will enable enterprises to survive and develop steadily in the

future. However, still now most of enterprises follow neither objective nor scientific estimate method and are still facing with occurrence of frequent and indefinite claims from their clients. So they are suffering great damage in judgment of right or wrong.

In spite of an importance of the scope there has been very few relevant reported works in literature. In particular, Olsen[1] analyzed the prime cost for magnesium die casting mould in 1988, and Rosen et al.[2] studied and presented the prime tool cost for injection mould and die casting in 1992. On other hand, some large enterprises have developed their own system for mould prime cost calculation. However it usually can be applied only to some specific conditions. Clearly that the variety of real situation and need at many enterprises requires general but much more sufficient approach and development.

In order to remove such a problem, this study aims to build up an expert system in order to handle mould for display means. The built up system consists of Ini-MOULD 2002TM for initial estimate calculation.

STANDARD PROCESSING TIME FOR MOULD MANUFACTURING

Standard Processing Time

Based on researches so far, the standard process time in mould manufacturing can be measured by the Time Study Method, Pre-determined Time Standard Method and Standard Data Method, etc. Figure 1 is showing the content of mould processing time by disintegrating its structural elements.

- **Preparatory time, Setting time:** It includes time for preparing clearance and spare time for preparing as necessary preparing and clearing for machine processing occurred only one time for specific manufacturing quantity (1 processing lot) of the same processed good. Much time for thinking how to work is included in the preparing work. Generally speaking, we don't separate time for clearing from the time to spare in considering the preparation time. From the mould processing stage to the stage of finishing preparation requires some time for test processing.

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- **Cycle time:** The time necessary for mould processing for a unit of processed good includes the real repeat time (the real processing time and the real supply demand time) and the time to spare.
- **Net cycle time:** The repeat clearing time includes the machine time (real processing time) of automatic transfer and manual transfer, and the supply demand time (real supply demand time) accompanied to the mould processing. The necessary clearing time for cutting after the machine is operated includes the time for removing cutting chips or the time for air cut, when the cutting chips are not discharged due to approach to tools and over run. In the case of the NC machine, it is the length of time for tools to approach the processed goods from the machine origin to return the original location after finishing the necessary cutting.
- **Net handling time:** As doing mould processing for a unit of the processed good, it's the worker's working hour, such as installation and removal of the processed goods, maneuvering of machines and measuring of the processed goods, occurred incidentally.
- **Automatic feeding time:** It's the real processing time in the case that the mould processing is implemented through automatic transfer or numerical control.
- **Allowance time:** As a factor occurred irregularly during the repeated work, it's the length of time considered as time to spare since the insert is difficult during the real repeat time. The allowance time is calculated by multiplying the values required man hourly and materially in the type of percentage by the real time. The spare man hour means the fatigue spare to compensate the damage appeared due to the fatigue during work, and the physiological spare, such as going to the lavatory and drinking water, etc. The material margin means the so-called work margin, such as the irregular and various time to spare occurred materially from machines, tools and materials, etc.

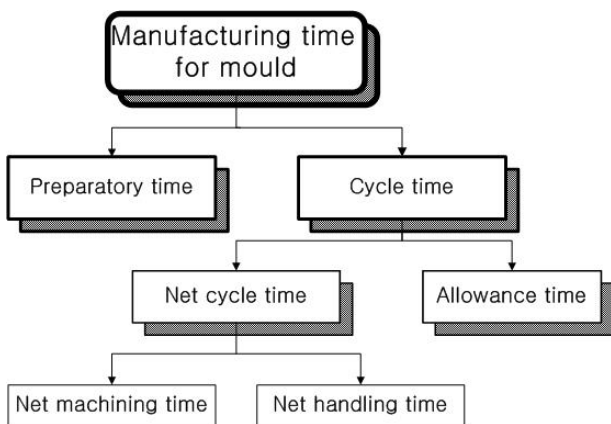


FIGURE. 1

CLASSIFICATIONS OF MANUFACTURING TIME FOR MOULD.

There is a work place margin to compensate the time to spare occurred due to the managerial irrationality during work. It is not related with mould processing, and divided by the non-processing time.

CONSIDERATION OF THE MOULD FOR DISPLAY MEANS

In the case of TV products, we are going to examine in this study, are moulds composed of big mould base, having 1 cavity. The mould base can not use the standard type. A TV mould part can be largely divided by two parts, front and back. We are going to research on the front and the back.



FIGURE. 2
FRONT PART OF TV PRODUCT.



FIGURE. 3
BACK PART OF TV PRODUCT.

Figure 2 shows the front part. The front is characterized by the precise small electrical discharge machining to accommodate speaker holes in the front side and the installation of the bottom side core for installing a control knob in the bottom side.

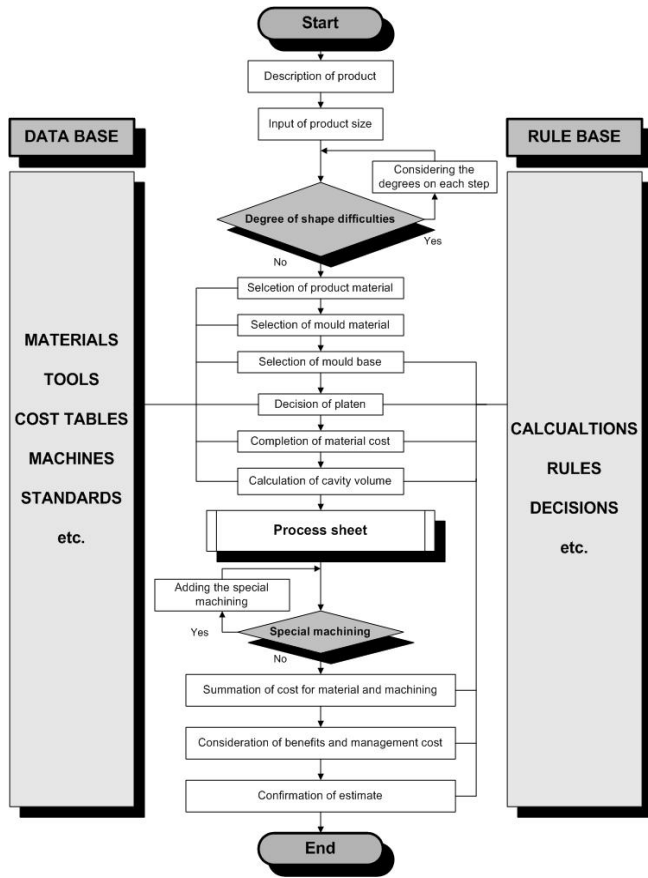


FIGURE. 4
MAIN STRUCTURE OF SYSTEM.

Figure 3 shows the back components. The pivotal point is to calculate the processing time for machining a lot of holes for air vent on the back side and for the milling machining to make deep cavities. Also, a lot of electrical discharge machining is required to form the bosses and the ribs. The calculating technology for the standard processing time of mould manufacturing is needed by both sides of placing and receiving orders at the same time. The order placing side can utilize it for suggesting standards and the order receiving side can utilize the system for producing quotations, considering the company's working load. The suggested amount can be modified through verification and coordination, and the final quotation can be decided objectively.

Figure 4 shows the organization of the developed system. The input data for the system includes the general specification, size, materials and mould base type, etc. The material cost and processing cost are calculated based on

those things. The mould base can be selected by deciding the weight of mould base and the size of the stationary and movable platen. The decision on the cost for hot runner and other mould factors is made in this stage. The processing cost is divided by the general processing cost and the special processing cost. The general processing cost means the cost for each process, from design to test, required to make a mould. We have established a system to calculate the processing time for the pertinent processing factor by inputting specific processing parts and shapes for the contents that are included in special processing cost like polishing, carving, core machining, corrosion and electrical discharge machining, etc.

The output unit calculate the mould manufacturing cost considering profits and general expenditures, and the processing cost, standard manhour rate and standard processing time for each process are printed on specific forms. The system is designed to store the results into the database for future reference in preparing quotations for the similar products and for the records management.

Process Sheet

The previous study[3] calculates all factors of moulds by repeating the degree of shape difficulty, and then the standard processing time for special processing is calculated by considering the necessity of special processing. In this case, we were able to get the adequate result if the mould is based on the standard mould base or the mould assembled by the standard mould factors.

PartName	Material	Quantity	Part	Process
HP-4A	HP-4A	1	6	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
HP-4A	HP-4A	1	6	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
HP-4A	HP-4A	1	3	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
HP-4A	HP-4A	1	9	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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HP-4A	HP-4A	2	3	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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HP-4A	HP-4A	1	9	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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HP-4A	HP-4A	1	5	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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HP-4A	HP-4A	4	3	01 TO1, 40E01, 75001, 253001-00301, 40301, 70301, 23001-00601, 0501, 70301, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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