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An Expert System For PC Mold-Base Selection On The AutoCAD

조 용 무(대유공업전문대학 금형설계과), K. K. Wang(Cornell University)
Yong-Moo Cho (Daeyeu Tech. College), K. K. Wang(Cornell University)

ABSTRACT

본 논문은 사출금형 설계를 위한 전문가 시스템의 개발에 관한 연구이다. 설계자가 오토캐드(AutoCAD) 환경에서 금형부품 및 몰드베이스를 3차원 형상으로 나타낼 수 있으며 필요한 설계 데이터를 추가할 수 있는 프로그램 개발에 있다. 주 프로그램은 C++를 사용하여 구축하였으며, 금형부품 치수 및 몰드베이스를 데이터 베이스화 하였다. 주 프로그램과 오토캐드와 인터페이스를 하여 오토캐드 환경에서 자유롭게 사용할 수 있도록 하였다. Pull-down menu와 Dialog box를 이용하여 금형 설계자가 금형의 각 부품을 자유롭게 선정할 수 있으며, 각 단계별 선정된 금형 부품은 즉시 나타나 설계자가 바로 확인 할 수 있도록 하였다. 이젝터 핀의 위치 및 크기를 자동적으로 나타낼 수 있으며, 선정된 금형 부품 및 몰드베이스는 2차원이나 3차원으로 나타낼 수 있다. 각각의 3차원 부품을 독립적으로 나타낼 수 있어 NC프로그램과 인터페이스가 가능토록 하였다.

Key Word : Plastic Injection Mold Design(사출금형설계), Expert System(전문가시스템), Mold-base(몰드 베이스), ARX(AutoCAD Runtime Extension), ADS(AutoCAD Development System)

1. INTRODUCTION

Many programs[1-2] have been developed to reduce the time to design a mold. Since the mold-base and mold components are parameters in the design programs, they could be automatically drawn for the designer to input the dimensions. Several authors[3-4] have been concerned with mold-base selection programs for different standards. There programs are typically used test-input menus and FORTRAN language run in a UNIX environment. In many cases, only wire-frame or surface models are produced. In addition, there mold-base selection programs are often complete independent of the injection mold design and analysis package.

Mold designers nowadays often use AutoCAD programs running on personal computers. With AutoCAD, designers can employ dialog boxes to assist in their work. Such boxes are defined by dialog control language files, "programmable dialog boxes", which are supported by AutoCAD, and defined by ASCII files written in dialog control language. The arrangement of the tiles in a dialog box is determined by the order of the tiles in the dialog control language. In addition, it is possible to interface between C^{++} and AutoCAD[5-6].

It is the purpose of the present work to develop an interactive the system which uses pull-down menus and dialog boxes that include illustrations for the mold parts. The system creates 3-D solid models for the Futaba standard mold-base assembly which enables linking analysis and design programs.

2. STRUCTURE

2.1 Language

The layout of the program is organized in terms of visual C++ language, AutoCAD and external files. Figure 1 shows the layout of the entire system. Visual C++ can be used in the main programs which include the mold-base selection algorithm, the control of dialog boxes and solid-model creation. It is noted that C++ has a dynamic only linked library which contains library files functions. A programmer can integrate a dynamic only linked library file into his program and use its functions.

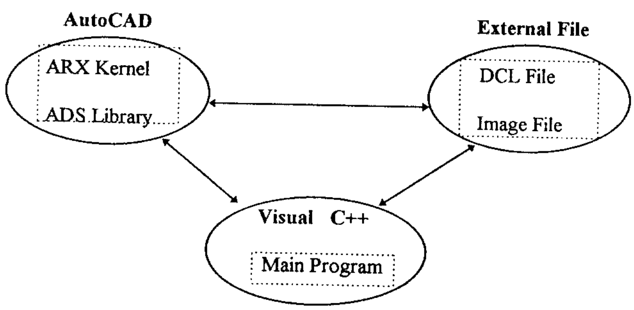

Fig. 1 The layout of plastic injection mold parts and mold-base selection program.

It is also possible to directly link and control the AutoCAD commands and to distribute the library files together with the EXE file of AutoCAD.

2.2 Main Programs

The structure of programs are organized menu file, header file, main source file, database file, DCL file and image file as a figure 2.

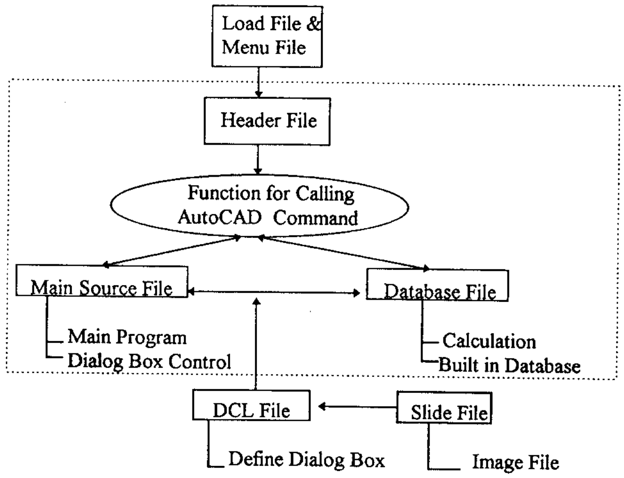

Fig. 2 The program structure of plastic mold parts and mold-base selection program.

The main programs which control dialog box, solid model creation and mold parts, are organized by of pull-down menu files, main-source cords and slide files. Figure 3 show the main programs. The sequence for choosing the mold-base is to first choose a commercial name in the pull-down menu which is defined by the AutoCAD menu file. In industry, the mold base can be identified by its commercial name which is associated with a given company. These menus contain script files that are written in AutoLISP language. They contain current directory information and can be edited or modified easily with a text-editor. There are also partial menus which are loaded into the preexisting AutoCAD base menu.

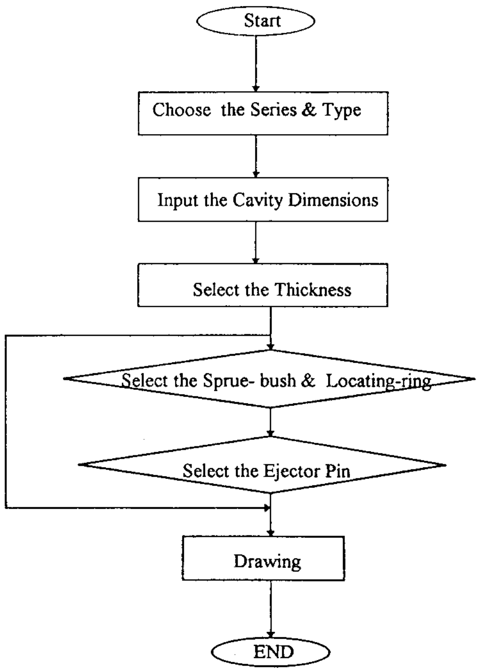

Fig. 3 The main program of mold-base and parts selection program.

A dialog box consists of the box itself and the components, or tiles, within it. It can be defined by a compiled code for program execution as well as recommended messages which may error or warning messages. It can be created by complex tiles, called subassemblies, that let the user define groups of tiles by grouping them into rows and columns, with or without an enclosing box or border. DCL also enables the user to define prototype that are not necessarily associated with a specific dialog box.

The slide files can be used to show a the picture of the mold components. It is possible for the beginner of mold design to understand easily. They are automatically loaded into diagrams in the dialog boxes during the process.

3. PROCEDURE

The first step in using this program is to determine the series of mold-base which is to be used. Within the AutoCAD environment, the user can access the program through pull-down menus. The menu files are partial menus of AutoCAD main menus of AutoCAD main menus which are automatically loaded with the script file. It is possible to integrate other mold-base standards using this approach. The designer must determine length and width of cavity, including runner and gate. The program asks for the maximum cavity length and width. After being inputted, the program calculates the mold plate size automatically. Figure 4 shows the dialog box for the mold plate.

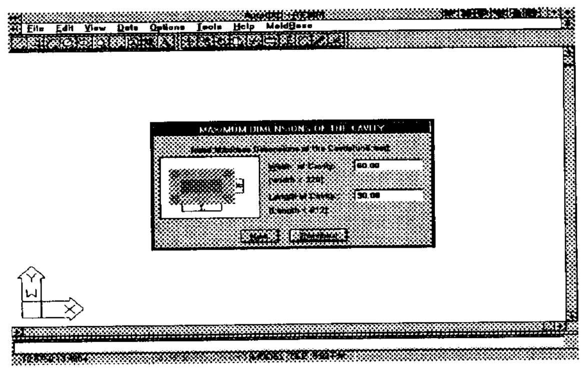

Fig. 4 The dialog for the maximum dimensions of the cavity.

The user input is next asked to select the thickness of the mold plate. The dialog for mold-plate thickness includes the upper, lower and support plate as well as space block. Often selecting, the thickness of these plates, the program automatically creates the top clamping plate, bottom plate and runner stripper plate. All of the thickness have pull-down menus to list the choices. Figure 5 shows the dialog box for thickness. At this point, other parts of the mold base generated.

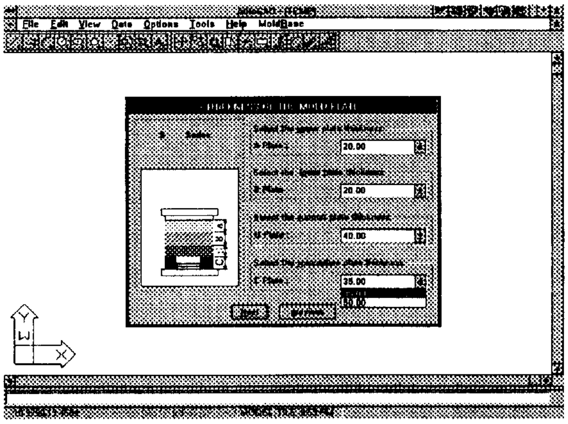

Fig. 5 The dialog for selection of thickness of the mold plate.

The designer can next see solid models related to the background. Figure 6 shows solid models and the dialog box for the locating ring and sprue bushing. If the model is not what is desired, the designer can go back to the previous dialog box by selecting "Previous". If the model is a correct, the designer can select the diameter of the locating ring, sprue-bushing nozzle and sprue-bushing. After selection, the model of the background will add the locating ring and sprue-bushing.

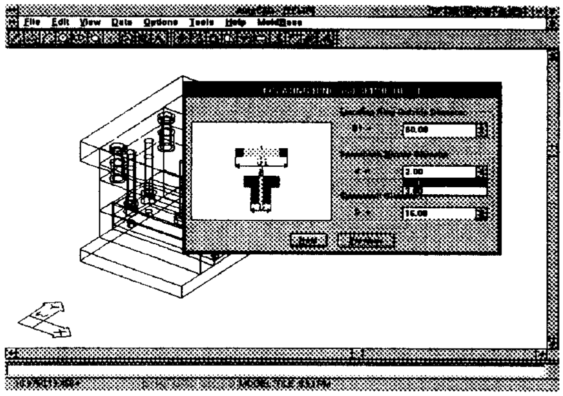

Fig. 6 The dialog for locating ring and sprue bushing.

The next step is the dialog for the ejector pin. If the designer does not want to select these, it is possible to pass this dialog. After selecting the number of ejector-pins, one can select the diameter and locations of the ejector-pin. These locations can be entered interactively by picking the points or manually typing the values. Figure 7 shows the of ejector-pin dialog.

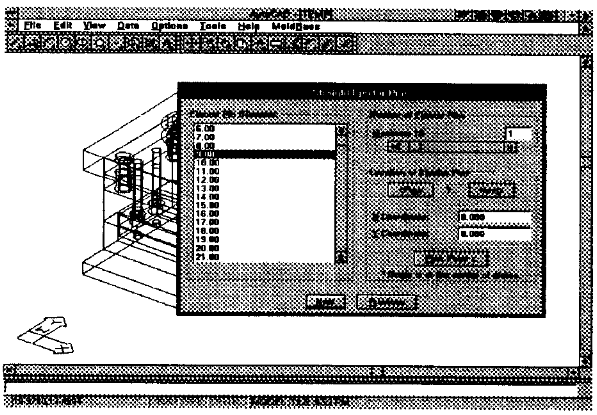

Fig. 7 The dialog for selection of the ejector pins.

The final dialog concerns how to draw the mold-base. The current program provides 3 different possibilities, namely isometric view, exploded view and projected view. It is also possible to select 2D or 3D. If the designer wants to see 3D types of mold-base, he can select the normal view, as illustrated in Figure 8. The program can also generate the dimensions of the components. The designer can easily understand the 3-D geometry from these various views and can select the mold parts independently. It is also possible that the designer can add the special mold parts. It will also be interfaced with analysis programs and NC code-generation programs for machining the cavity and core.

The system will next be developed as a single package for integrating cavity design, gate and runner design, cooling channel design and slide core design. It will also be interfaced with analysis programs and NC code-generation programs for machining the cavity and core.

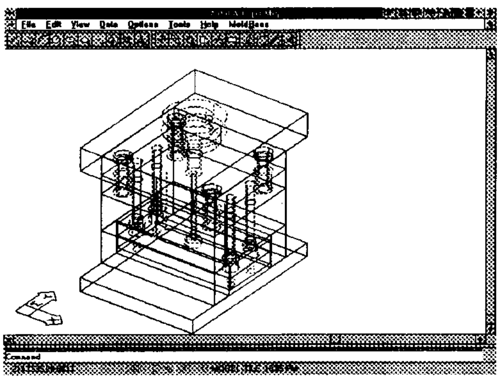

Fig. 8 The normal view of mold parts and mold-base(SA-Series).

4. CONCLUSION

In this work, we have been concerned with developing an intelligent system for mold-base selection. We have concentrated on building a viable environment, including a dedicated relational database and a menu-driven user interface. This provides a more interactive and interface for selection of optimal mold-base and mold parts.

This work presents a method which allows the designer to select the mold parts and mold-base directly within an AutoCAD environment. It can also automatically generate detailed drawings of the mold parts and mold-base.

The system shows its potential capability for future enhancement. Since the system is independent of the data, it could easily be extended to other mold-bases and mold parts. In addition, it can be linked to the mold-design system by creating subtracted 3-D models.

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