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Research on IGES Graphic Input and Display Technology Based on Feature Information

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Abstract: In order to input graphics of NC machining parts efficiently, now take the turning IGES rotary parts graphic input for example, it introduced the manual input and methods of obtaining the feature information of the parts generated from UG5.0 IGES file. The feature information contains geometry information (such as line, arc, spline curve, etc) and process information (such as size tolerance, form tolerance, technical conditions and the title bar, etc). In VC++6.0, it set up three modules, that's the IGES file information input, data processing and data output. Feature extraction and input were realized by using intersection algorithm of graphic elements. Through data processing module, the read pixel information could be transformed into the feature information of the parts, generating the system data structure. OpenGL technologies were used to realize the IGES graphics display, finally offering supports for NC turning visualization of virtual machining.

Preface

Along with the computer technology application in the field of mechanical manufacturing, it greatly promotes the development of NC machining technology, and various new types of CNC equipment and advanced processing methods appear. As an important part of NC automatic programming system, the application of graphics part information input in the NC processing is becoming more and more widely. It can provide all parts' feature information, and the feature information transformed can generate the actual NC processing codes, which greatly improves the efficiency of machining [1]. Especially in recent years, scientific and efficient NC machining methods are constantly emerging, adapt to the needs of society development. Backward and inefficient traditional manual programming model isn't adapt to the requirement of automatic NC machining time, gradually disappearing from the history stage. Therefore, how to make scientific expression, input graphics part information quickly and efficiently, realize the automation of the NC programming, has become a sort of practical problems NC machining and large-scale production need to solve. It is also the research direction for various countries' scholars, experts in the related fields [2,3].

In particular, AutoCAD software is the most widely used in mechanical design aspects in our country, such as CAXA, UG and Pro/E software systems. Although these software are able to complete all kinds of graphic design and graphic input task, however drawn graphics data structure aren't adapt to CAPP/CAM module by using the feature information, leading to low graphic input efficiency, and they can't get the data structure NC machining required, which will directly affect the quality and efficiency of NC machining [4]. Therefore, it needs to read AutoCAD graphic data, and translate the data into the data structure NC automatic programming system needs. According to the display mode, the program can reappear the original data of the system. Our team also has carried on the development of manual input module. Users are able to input the parts geometry

information and process information. After data processing, system translates the data input into the system structure, which could be used for NC machining.

IGES Brief

IGES file structure is shown in figure1. Figure1 shows that IGES file is composed of six sections, followed by flag section, start section, global parameter section, directory enter section, parameter data section, terminate section.

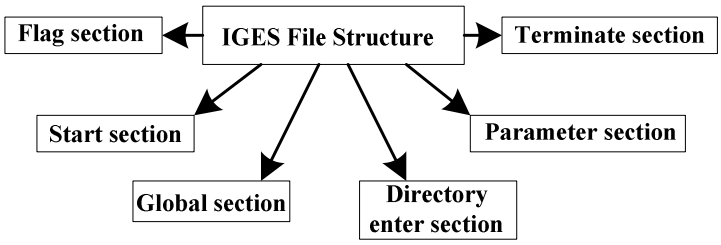

Fig.1 IGES file structure

The six sections are respectively introduced below [5]:

(1) Flag section: It Points out that the file is binary format or ASCII format. ASCII formats is divided into two kinds of compression and a fixed length. When the fixed ASCII format appears, there is no file no flag section generated in IGES;

(2) Start section: It Stores the information the users can read, and gives us a preliminary understanding of the IGES file;

(3) Global section: It Stores the global information of the IGES file, and demonstrates the master of documents;

(4) Directory enter section: It provides an index for the file content, and contains the special attributes information of each entity;

(5) Parameter data section: It presents all the geometry parameter information of each entity;

(6) Terminate section: It is also called summary section, which stores the number of rows of the four sections above, which is helpful for the users to pinpoint the start and end position of each section.

This system uses VC++6.0 as the software development platform. According to the characteristics of axial parts (same characteristics along the center line of the rotary parts), it simplifies the rotary parts to 1/2 center line profile form (as is shown in figure 2). The dynamic array class (CObArray) is used to store data. Through the rotary parts' geometry information and process information, the outlines of graphic parts are reproduced, with entity process and overall information. After transforming data, it generates the system uniform data structure.

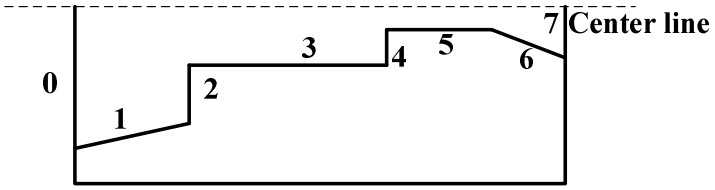

Fig.2 Simplified 1/2 rotary part

System Data Structure

Data structure after processing

Through the data processing module, we could get the outline of the rotary parts. The geometry is composed of line, arc and b-spline curve, and each entity line with specific technology characteristics.

Figure element intersection

Figure element intersection has three sub functions: line and line intersection (CNCPRODoc: : ZXQJ ()), line and curve intersection (CNCPRODoc: : ZXQX ()), curve and curve intersection (CNCPRODoc: : QQXJ ()). Here take line and curve intersection algorithm as an example of introduction. Line and curve intersection diagram is shown in figure 3.

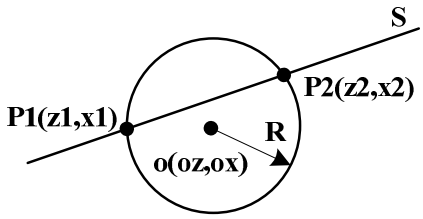

Fig.3 Line and curve intersection

Line equation:AX+BZ+C=0;

Arc equation: $(X-ox)^2+(Z-oz)^2=R^2$

Take the above two equations, we can get the valid intersection point coordinates: p(Z1,X1)和p(Z2,X2).This module needs to call CNCPRODoc::zxqx() to realize.

Key codes：

```
int CNCPRODoc::zxqx(double a,double b, double c, double ox, double oz, double R)
    { int K;//The number of intersection points
      double x1,z1,x2,z2;//coordinate variables definition
       ……//the calculative process
       zq1.x=x1;zq1.z=z1;//get the intersection point coordinates
       zq2.x=x2;zq2.z=z2;
       return K;}
```

The intersection of line and curve shows that no matter in what way the user inputs figure, as long as the standard equations of the pixels are calculated, we can get the intersection point coordinates for figure input.

Test Results

To test the experimental effects, in UG5.0 firstly draw a IGES format test piece. Then run the application, import the test piece, after data processing, the system data structure is shown in figure 4. Figure 5 shows the 3D data display result of the test piece.

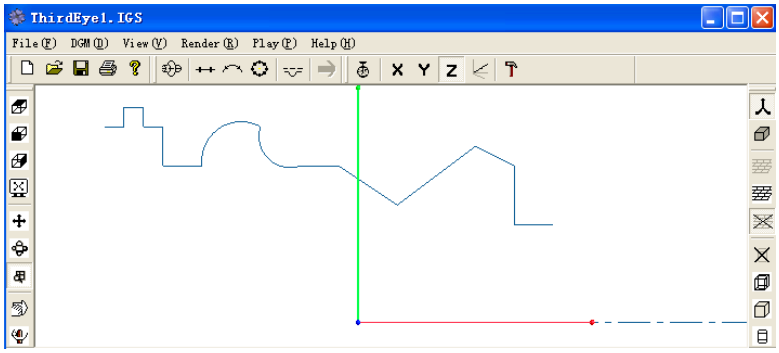

Fig.4 System data structure

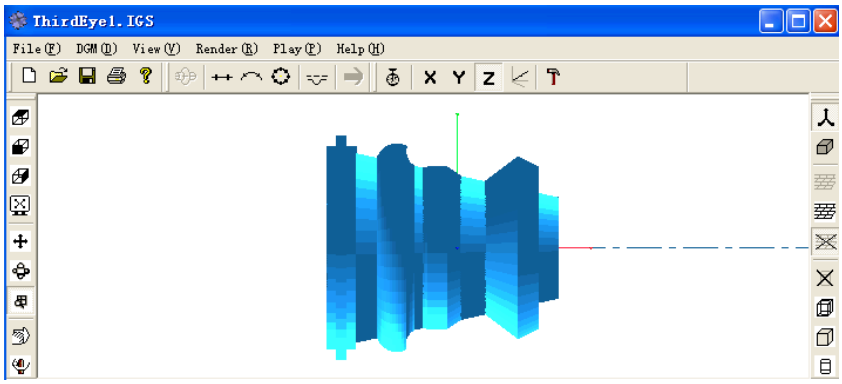

Fig.5 3D data display

Conclusions

By reading the IGES rotary parts, the system can input the figure element information. After data processing, the information of rotary parts is finally transformed into the uniform data structure, and the 3D graphical representation is realized according to the requirements of the system. At present, the system has been applied in the NC machine processing in the engineering training center. Some conclusions go below:

(1) Data of rotary parts in IGES format files can be accurately input, and generate the system data structure;

(2) Use the mouse click on the solid surface, users could make process information query and modification, more intuitively and conveniently.

(3) Further improving the data structure of system can better meet the needs of actual production.

References

[1]SUN Yan-hua, ZHANG Chen, ZHOU Lai-shui. Technology of part information input for NC turning programming system based on DXF files[J].Machinery Design&Manufacture,2011(6):211-213.

[2]Mohammad T.Hayasi, Bahram Asiabanpour. Extraction of manufacturing information from design-by-feature solid model through feature recognition[J].The International Journal of Advanced Manufacturing Technology,2009,44(11/12):1191-1203.

[3]Bahram Asiabanpour, Ali kamrani, Alireza Mokhtar,et al. An overview on five approaches for translating CAD data into manufacturing information[J].Journal of Advanced Manufacturing System,2009,8(1):89-114.

[4]LIU Jun, GAO Xiao-li, MA Yan-ru, et al. NC Automatic Program and Machining Simulation System for Axle Part[J].Modular Machine Tool&Automatic Manufacturing Technique,2007(5):82-83.

[5] XIAO Haijun, LI Hao. Implementation of pre-processor for trimmed surfaces of initial graphics exchange specification[J].Journal of Computer Applications,2013,33(s2):130-132.