The Research of CAPP Base on Information Table

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Abstract**—**According to the needs of intelligent computer aided process planning, combined with the method of parts elements describing and the method of parts classification code, an information model of parts can be build up. The knowledge base is set up with the help of the success stories. According to the method designed in this paper, based on the knowledge base for inference processing technology needed for reasoning, automatic processing methods derived option. Hole finishing with an example, utilize 20 success stories, Of 9 test cases to test alternative processing methods to achieve 100% accuracy rate.

Keywords- Information table; Computer Aided Process Planning; Process Decision; knowledge base

I. INTRODUCTION

CAPP (Computer Aided Process Planning) is a computer technology and various other related technologies used in process design integrated product, it is part of infomationization modern manufacturing. Take advantage of computer aided process CAPP software, Engineer design the process of part from rough to finished. CAPP since its birth, its research and development has been booming at home and abroad. As computer technology and application technology continues to develop, the CAPP application in mechanical engineering become increasingly important. Computer aided process planning system characteristics through the retrieval type, derived type, mixed typed and generative type

According to the demand for intelligent computer aided process planning, The parts needed information were encoded in this paper, According to information theory methods, the input information encoding were composed information table, This paper designs a method, with the help of the knowledge base that constructed by analyzing the information table composed by the successful cases, Infer the correct processing.

Using the method of designed computer aided process planning reasoning in this paper to reason test the finishing of internal hole, 20 successful cases were input to construct the knowledge base, and 9 unknown cases were input to test the method. The conclude show that successful reasoning out of the processing method should be chosen.

II. CONSTRUCTION INFORMATION TABLE

According to intelligent reasoning and application needs, the processing data of parts used in this paper was constructed by the mixed encoding system that tree structure combined with chain structure. 20 bits was used to express this encoding. The information of parts used in this paper was divided into sever parts as follow: basic elements outline size, external shape and precision, internal shape and precision, and other characteristics, each used several coding to express. In reasoning process of finishing the hole. The mainly elements used in reasoning process of finishing the hole was include as follow: Final pore size, production volume, precision grade (IT), roughness (Ra) and form-position tolerance. If the material is black metal and no heat treatment the hardness requirements, the processing methods selected were reaming, fine boring, grinding holes or broaching. According to "condition attribute -> decision attribute" information table structure, then it can draw the following head of information table 1.

The Final pore size, production volume, precision grade (IT), roughness (Ra) and form-position tolerance is condition attribute, and processing method is decision attribute. Their range is defined as follows, respectively:

(1)Final pore size: Final aperture ={large hole, middle hole, small hole}; / Final aperture to $\leqslant$ 20mm,> 20 $\leqslant$ 40,> 40 division.

(2)Production volume: volume= {large, middle, small}; / to $\leq$ 1000,> 1000 $\leq$ 5000,> 5000 division.

(3)Precision grade: precision grade IT={7, 8};

(4)Roughness: roughness Ra={0.8, 1.6}

(5)Form-position tolerance: form-position tolerance ={0, 1, 2, 3}

Processing method is decision attribute the range is defined as {reaming, fine boring, grinding holes, broaching}.

Arranged the successful case as in table 1 according to the encoding rules, we constructed the reasoning process Methods Knowledge Base.

Processing methods during the process of reasoning, reasoning within the finishing hole, for example, on the choice of different processing methods, the important of the five processing elements is not the same. For example, if the form-position tolerance=1, the

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probability of processing methods selected reaming is 0. Case analysis of the maturity and method of processing and selection experience, create the attribute weights table. Case of the finishing of internal hole, Attribute weight table 2 as shown below.

Table numbers and property values were as follows:

Final aperture ={large hole, middle hole, small hole}, {1,2,3}

volume= {large , middle ,small },{1,2,3}

IT={7,8},{1,2}

Ra={0.8,1.6},{1,2}

form-position tolerance ={0,1,2,3},{0,1,2,3}

This paper introduces Fibonacci sequence for reasoning, such as the number of condition attributes are divided into One, two, three, four, five, the relative weight of each match should be calculated as {5,8,13,21,34 }.

III. ALGORITHMS

This algorithm and the algorithm are verified using MATLAB as a programming tool, the specific algorithm described as follows:

Step1: Initialization, the introduction of different processing methods of different variables wo (i) = 1, i = 1,2,3 ..., read the Knowledge Base at, read the corresponding inference the weight table bt; read into the Fibonacci sequence fi, according to input, in accordance with the coding rules need to read the item condition attribute reasoning group de;

Step2: Classification of the knowledge base, depending on the decision attribute, the knowledge base is divided into several sub-table a1, a2, a3 ...;

Step3: Matching calculation, the paper selection Attribute weights process using the following formula method of matching the weight:

wop(i)=wo(i)+fi(j) (1)

where wop(i) is the weight of type i processing methods, fi(j) is the j item of Fibonacci sequence and j is that there are j conditions to participate in operations,j=1,2,3,4,5,...

Weight calculation processing method in this paper as follows:

$$tt = \begin{cases} 0.....\exists i, a(i) \neq b(i) \\ 1...\forall i, a(i) = b(i) \end{cases} \tag{2}$$

Step4: Modify the weight of processing methods, according to the weight attribute table, the weight calculation processing method as follows:

wo(i)=wo(i)*bt(i,j) (3)

Step5: Output options processing methods, according to wo, choose the maximum value wo (i).

IV. ALGORITHM VALIDATIONS

Construction Knowledge base as table 3.

This paper selects nine test cases, test cases the following table 4.

The input results and the calculate results Contrast as the following table 5.

V. CONCLUSIONS

From table 5, we can draw the conclusion that the optimal processing method chosen was 67% accurate, the optional processing method chosen was 100% accurate, That shows according to the knowledge base , using this method, can reasoning the accurate processing method. A shortcoming of this method is that in the knowledge base exist the redundant rules; Reduce the efficiency of the algorithm. The next step needs to extract knowledge base rules, improve the efficiency.

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TABLE I. HEAD OF FINISHING HOLE INFORMATION TABLE

Final pore size	production volume	precision grade	roughness	form-position tolerance	processing method

TABLE II. ATTRIBUTE WEIGHTS TABLE

	Variable value	reaming	fine boring	grinding holes	broaching
Final pore size	1	0	1	1	0.7
	2	0.7	1	0.7	0.5
	3	1	0.5	0.3	0
production volume	3	1	0.5	0.3	1
	2	1	1	0.7	0.3
	1	1	1	1	0
precision grade	1	0.7	0.7	1	1
	2	1	1	0.5	0.7
roughness	1	0.5	0.7	1	1
	2	1	1	0.3	0.5
form-position tolerance	0	1	1	1	1
	1	0	1	1	1
	2	0	0.7	1	1
	3	0	0.5	1	0.7

TABLE III. KNOWLEDGE BASE VERIFICATION ALGORITHM

	Final pore size	production volume	IT	RA	form-position tolerance	processing method
1	1	1	1	1	0	2
2	1	2	2	2	1	2
3	1	3	1	1	2	4
4	1	1	2	2	3	3
5	1	2	1	1	0	2
6	1	3	2	2	1	4
7	1	1	1	1	2	3
8	2	2	2	2	3	2
9	2	3	1	1	1	1
10	2	2	2	2	2	2
11	2	1	1	1	0	1
12	2	2	2	2	1	1
13	2	3	1	1	2	4
14	2	1	2	2	3	3
15	3	2	1	1	0	1
16	3	3	2	2	1	1
17	3	1	1	1	2	3
18	3	2	2	2	3	2
19	3	3	1	1	0	1
20	3	1	2	2	1	2

TABLE IV. TEST CASE TABLE

	Final pore size	production volume	IT	RA	form-position tolerance
1	1	1	2	1	1
2	1	2	1	2	0
3	1	3	2	1	3
4	2	3	2	2	1
5	2	2	1	1	2
6	2	1	1	1	3
7	3	3	1	2	0
8	3	2	2	1	1
9	3	1	1	2	2

TABLE V. TABLE OF THE INPUT RESULTS AND THE CALCULATE RESULTS CONTRAST

input results	2、3	3、2	4	4、3	3、2	2、3	1	2、3	2
calculate results	2	2	4	4	2	3	1	2	2