DESIGN OF A COMPUTER AIDED PROCESS PLANNING TOOL (CAPP-S6) FOR SHAFT TYPE OBJECTS USING AUTO LISP AND C

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Abstract

This paper deals with the Computer Aided Process Planning system for shaft type of objects. The system is designed using C and Auto LISP for the process planning of six different types of shafts. It is a combination of variant and automatic process planning. The system takes input from the user, generates drawing of the work piece, simulates, and generates process plan for each part. The input data are the dimensions and the material specifications of the shaft. Different types of materials can also be selected using this programme. The process plans can be saved and retrieved again. The system also generates part code according to the shape and dimensions of the work piece.

Introduction

Process planning is that function within a manufacturing facility that establishes which machining process parameters are to be used to convert a work material (blank) from its initial form (raw material) to a final form, defined by an engineering drawing. The quality of the product and the cost of producing it are strongly influenced by the process plan. In the past, majority of the manufacturing systems were operated by human. Such system responds slowly, with incomplete or inaccurate information and an inflexible and slow process plan generation. Today, the production method is fast moving toward automation and computers are used to accelerate and improve the process planning systems. Computer aided process planning (CAPP) or automated process planning is an approach that uses computers to generate a process plan. CAPP can eliminate many of the manual decisions required during planning. It has the following advantages:

1. It reduces the demand of skilled planner
2. It reduces the process planning time.
3. It reduces the process planning and manufacturing cost.
4. It creates consistent and accurate plan and increases productivity.

There are three basic approaches to computer aided process planning: variant, generative and automatic.

The variant approach uses computer terminology to retrieve plans for similar components using table look up procedures. The process planner then edits the plan to create a variant to suite the specific requirement of the component being planned. Creation and modification of standard plans are the process planner responsibility.

The generative approach, however, is based on generating a plan for each component without referring to existing plans. Generative type systems are systems that perform many of the functions in a generative manner. The remaining functions are performed with the use

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without referring to existing plans. Generative type systems are systems that perform many of the functions in a generative manner. The remaining functions are performed with the use of humans in the planning loop.
An automated system, on the other hand, completely eliminates the humans from the planning process. In this approach the computer is used in all aspects, from interpreting the design data to generating the final cutting path.

System Description

The entire system is divided into four main modules:

1) The input module
2) Planning module
3) Drawing, simulation and plan generation module
4) Data storage and retrieving module

A description of the entire system is given in the flow chart (Figure 1). The four modules are described in the following section.

System Input Module

All the relevant data and the initial information necessary for material selection and the data input are collected in this module. The user has to:

1) Input the general information about the shaft i.e., part name, part number etc.
2) Input the dimensions according to the type of shaft to be manufactured.
3) Select material for the shaft.

The programme will itself select the material of the cutting tool depending upon the input data. A new data can also be entered from the input module or the data can be loaded from an existing file. The programme also has an option of changing the data. This module also creates a code for the part by a coding system developed by this system designer. This part code is also displayed on the process plan. The process plan system in its presents form can support only a limited number of features.

Drawing and Simulation Module

This module takes data from the input module and draws the drawing of a part using C graphics. There is an option of resuming the drawing automatically. If the dimensions are very small, it will zoom it to large size and if the dimensions are very large it will zoom it to small. In the drawing mode, at the bottom of the screen the bar shows the dimensions, material of the blank, type of shaft and its zoom ratio. An AutoCAD drawing of the part can be obtained by loading the Auto LISP file in Auto CAD.

In simulation, the module simulates the process of manufacturing of shaft, according to its shape dimensions. At the end of simulation, the process will show the finished product. An unexpected result will indicate wrong input of data, which can also be seen by the drawing of the job.

Process Plan Generation Module

This module generates the process plan of the part to be manufactured with necessary information. The plans can be saved and retrieved again. The plan will itself be saved by the

system by saving the file. Print of the plan can also be taken for documentation. This module contains all the necessary data for calculation of speed, feed, time, depth of cut etc. according to the material of the work piece and cutting tool.

Data Storing and Retrieving Module

This module contains all the previously saved data & plan files. Any new data added to the system will be saved by the code name in default. However, the user can also give a separate file name. It is one of the advantages of the system that the files are saved with very less memory space.

The structure of the programme is described on the next page with the help of a flow chart.

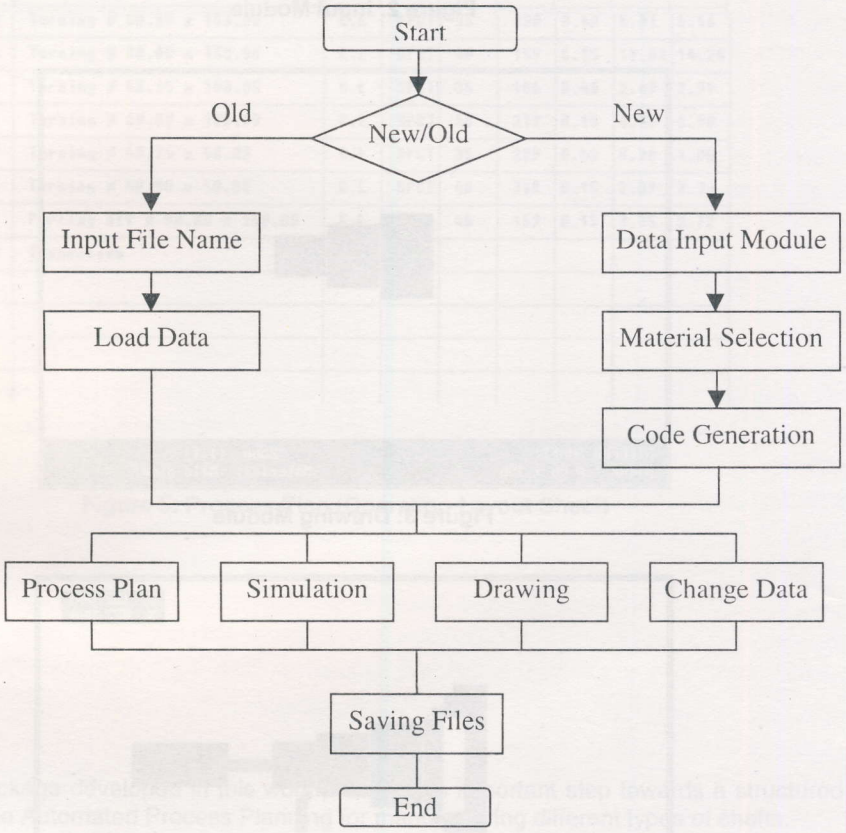


Figure 1: Flow Chart of the System

Case Study

For understanding the working of the system, an example is described below with figures. The Figure 2 shows the input module while inputting the data. Figure 3 & Figure 4 shows the drawing and simulation of the job respectively, and Figure 5 shows the process plan of the work piece.

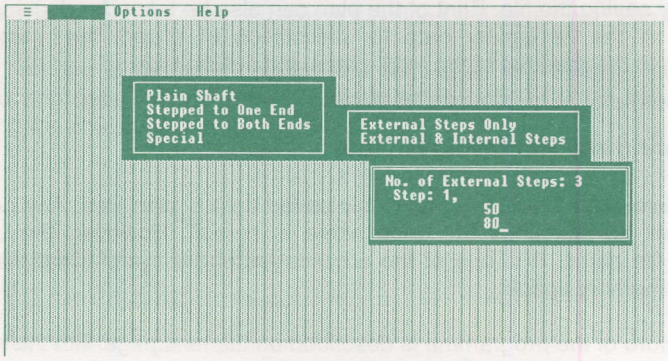


Figure 2: Input Module

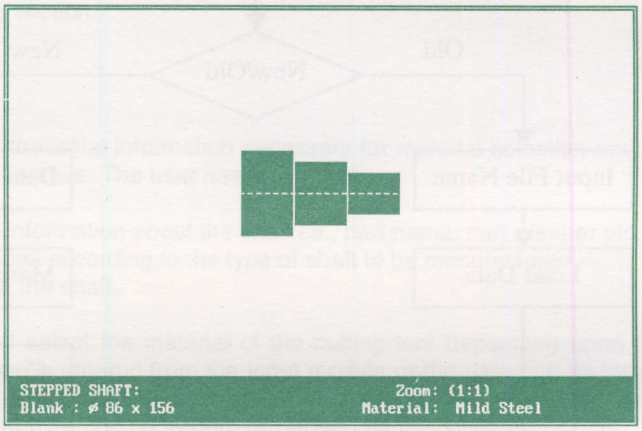


Figure 3: Drawing Module

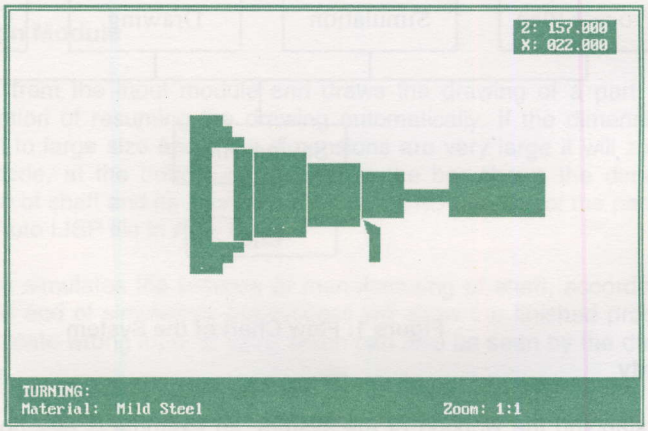
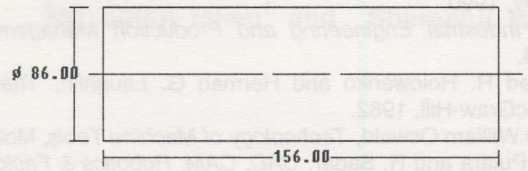


Figure 4: Simulation Module

OPERATION LAYOUT SHEET

Part Name: Shaft Part No : B-20 Part Code: 121301	Blank Dimension: ø 86.00 x 156.00 Material : Mild Steel App File Name : 121301.APP



Opr.	DESCRIPTION	M/C	C/T	SPEED	RPM	FEED	Tm	Top
01	Facing right ø 86.00 x 153.50	C.L	F.T	35	130	0.40	1.54	1.72
02	Facing right ø 86.00 x 153.00	C.L	F.T	40	148	0.15	3.60	4.00
03	Turning ø 80.25 x 153.00	C.L	SPCT	35	130	0.40	5.91	6.56
04	Turning ø 80.00 x 153.00	C.L	SPCT	40	159	0.15	12.82	14.24
05	Turning ø 60.25 x 100.00	C.L	SPCT	35	186	0.40	2.69	2.99
06	Turning ø 60.00 x 100.00	C.L	SPCT	40	212	0.15	6.28	6.98
07	Turning ø 40.25 x 50.00	C.L	SPCT	35	279	0.40	0.90	1.00
08	Turning ø 40.00 x 50.00	C.L	SPCT	40	318	0.15	2.09	2.33
09	Parting Off ø 80.00 x 150.00	C.L	PT	40	159	0.15	3.35	3.72
10	Inspection							

Figure 5: Process Plan (Operation Layout Sheet)

Conclusion

The CAPP package developed in this work provides an important step towards a structured approach to the Automated Process Planning for manufacturing different types of shafts.

The system performs all the major functions: Drawing, Simulation, Process Plan generation and saving and retrieving of the Plans. It is however the users responsibility to select and input the correct data and take important decisions during process planning. This system will help in reducing the time for the preparation of process plans and will also improve the efficiency and accuracy of manufacturing.

References

1. Tien-Chien Chang, *Expert process Planning for Manufacturing*, Addison-Wesley Publishing Company, 1990.
2. Martand Telsang, *Industrial Engineering and Production Management*, S. Chand & Company Ltd. 1998.
3. Allen S. Hall, Alfred R. Holowenko and Herman G. Laughlin, *Theory & Problem of Machine Design*, McGraw-Hill, 1982.
4. Steve F. Krar and J William Oswald, *Technology of Machine Tools*, McGraw-Hill, 1991.
5. B. L. Juneja, K. K. Pujara and R. Sagar, *CAD, CAM, Robotics & Factories of the Future*, Tata McGraw-Hill, 1989.
6. A. Gosh and A. K. Mallik, *Manufacturing Science*, Affiliated East-West Press Ltd., 1985.