PROCESS PLANNING USING A CAD/CAM SYSTEM

Dr. İhsan KORKUT[1]
Gazi University, Technical Education Faculty[1], Ankara, Türkiye
E-mail:ikorkut@gazi.edu.tr

Abstract

In this study, solutions with the help of CAD/CAM systems were sought for the problems encountered in part design, which is eihter for a machine part or a die element, and manufacturing. Initially, a part was modelled as solid and then this solid model was converted into a surface model. For the designed part, computer aided process planning (CAPP) was performed and CNC codes were generated. The CNC codes were sent to DYNA-2900 CNC milling machine using COMMUNIC command. The designed and modelled part was then manufactured on the milling machine using the necessary tools.

KEY WORDS: CAD, CAM, CAPP, CNC

1. Introduction

Increasing consumer demands are forcing the manufacturers to increase the range of the products and their quality while reducing the cost associated with their design and production. The consumer requirements for new products are increasing day by day. These requirements are due to the increase in the followings:

- Range of products,
- Physical appearance of products,
- Close dimensional tolerances.

In order to meet these requirements, a more accurate and flexible process planning is essential. In the many developed countries, designers and manufacturers are trying to adopt new technologies and strategies to improve quality and reduce cost. As the results of these attempts, computer technology has been used in the manufacturing industry. The use of computer, almost in every stage of the manufacturing industry, resulted in significant gains, like reduced lead-time, reduced cost and improved quality.

Computer aided design and production (CAD/CAM) applications lead to significant time reduction in the product design, process planning and production stages. In addition, the use of CAD/CAM improves product versatility and enables designers and manufacturers to design and manufacture more complex products with close dimensional tolerances. Therefore, CAD/CAM systems became an indispensable tool in the manufacturing industry [1,2].

2. Cad/Cam

After the second half of 20th century, CAD and CAM became the most important tools in the manufacturing industry to boost productivity and quality. Figure 1 gives the schematic diagram of CAD/CAM systems. One of the big problems encountered in the computer integrated (CIM) manufacturing environment is the preparation of machine tools and the transfer of the data generated in the computer aided design environment to the concerned machine tools. This stage in CIM environment can be defined as computer aided process planning (CAPP). Extraction of the part knowledge from the designed product, geometric definition, sequencing of the machine tool operation and transfer of these knowledge to the machine tool control unit in an understandable manner and functions of the machine tool according to the these data are the essential parts of CAPP systems [3,4,5,6].

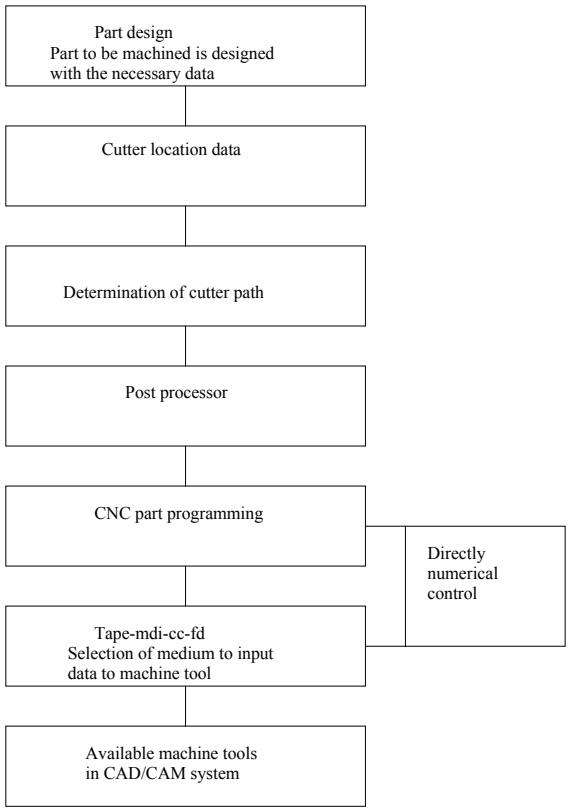

Figure 1. CAD/CAM System

3. Process planning in CAD/CAM systems

In Figure 2, the sample part for which CNC part program will be generated is seen as solid and surface model.

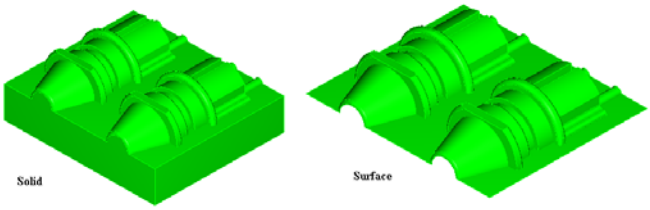

Figure 2. Sample part

Sample part has been modelled as solid and surface. For tool path definition, surface model was preferred. To generate tool path for the surface model given in Fig. 2, the following commands were used consequtively.

Figure 3. Command sequences for tool path creation

Rough machining is performed with the commands seen in Fig. 3. When the same command sequence is defined for finish machining and then if "Done" command is selected, the tool parameters data table comes on the screen as shown in Fig. 4.

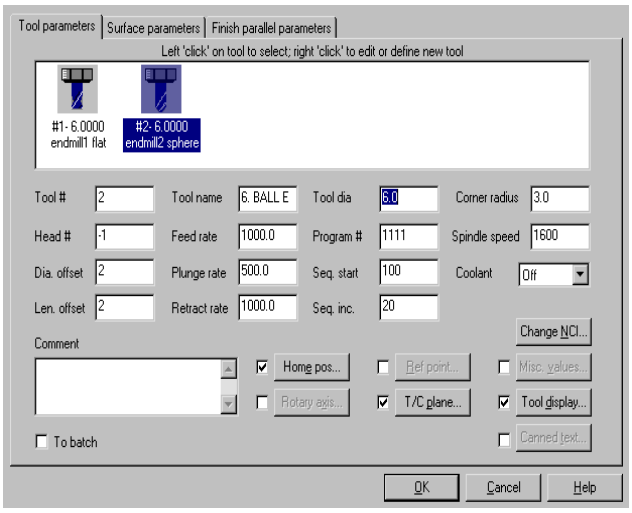

Figure 4. Tool parameters data table

Workpiece rough dimensions and cutting tools should be defined by entering reqired data in Fig. 4. By using the commands in Fig. 5, simulation for the sample part can be effected when "Machine" subcommand is selected.

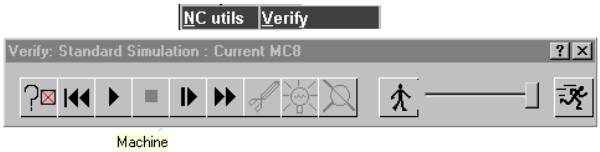

Figure 5. Simulation commands

On completion of the simulation, the sample part is seen as a finished product on the screen, Fig. 6.

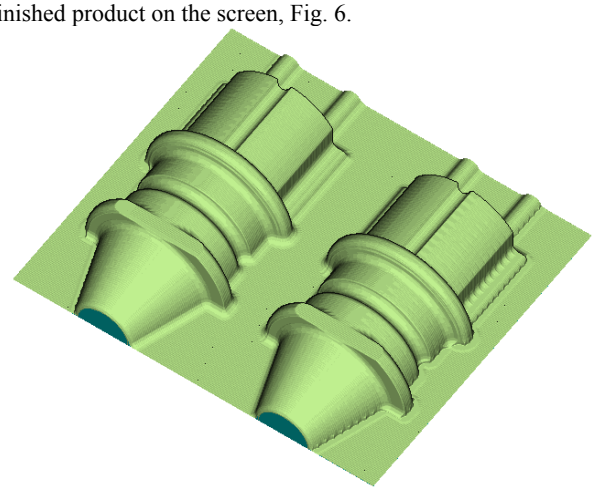

Figure 6. Sample part simulation

After the simulation, CNC part program is generated by applying the commands in Fig. 7 on the main menu.

Figure 7. Postprocessing commands

In the CAD/CAM system, CNC machine tool with its control unit (Fanuc) is defined and CNC part program (Fig. 8) for the sample part is generated.

```
%
O0111
(PROGRAM NAME – sample1)
(DATE=DD-MM-YY – 21-02-03 TIME=HH:MM -
23:26)
N100G21
N120G0G17G40G49G80G90
(6. FLAT ENDMILL TOOL - 1 DIA. OFF. - 1 LEN. - 1
DIA. - 6.)
N140T1M6
N160G0G90G54X24.743Y-2.927A0.S1200M3
N180G43H1Z60.
N200Z38.3
N220G1Z27.3F400.
N240X115.257F800.
N260G0Z32.3
N280Z50.
N300X0.Y0.
N320Z38.3
N340G1Z27.3F400.
N360X119.134F800.
N380G0Z32.3
N400Z50.
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Figure 8. Generated CNC part program

The generated CNC part program is sent to the machine tool by "File" and "Communication" program. When "Communication" command is selected, the data table, shown in Fig. 9 comes on the screen.

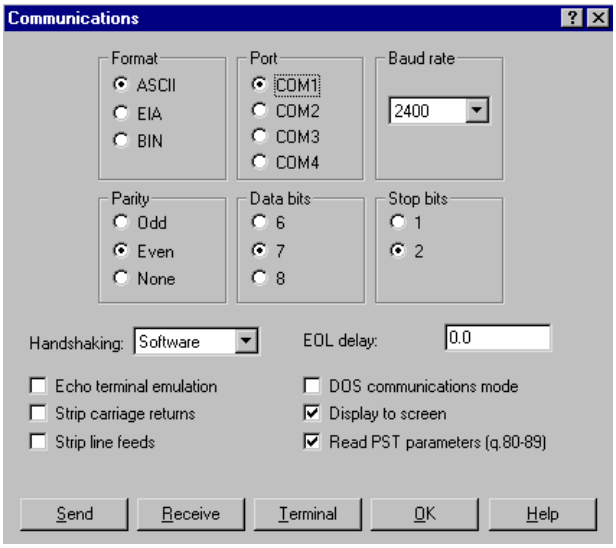

Figure 9. Comunication data table

When the required data is entered in Communication data table as shwon in Fig. 9, CNC part program is sent to the machine tool.

4. Conclusions

In manufacturing, CAD/CAM systems acts as a bridge between CAD and CNC machine tools and provide great benefits to the users in computer aided process planning stages. In this study, the benefits of CAD/CAM systems were shown through MasterCAM Release 9 Demo CAD/CAM software. Computer Aided Design, Computer Aided Process Planning and CNC machine tools have become very important concepts in the production industry. All the problems encountered in the all stages, from the part design, which is for eihter a machine part or a die element, to its manufacturing, were solved with the help of computer. Problem solving stages can be summarised as Design, Toolpath, Postprocessor and Communic commands.

5. Literature

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