



***MANUFACTURING
SCIENCE AND
TECHNOLOGY***

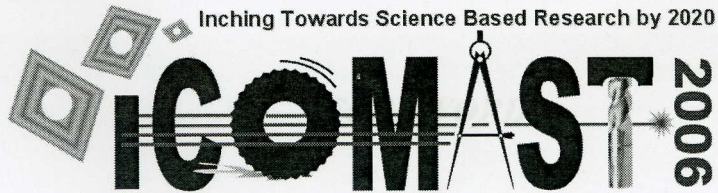
Edited by

V. C. VENKATESH

and

N. S. M. EL-TAYEB

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COMPARISON AND OPTIMIZATION USING NUMERICAL CONTROLLER MACHINE FOR SPORT RIM PRODUCT: MASTERCAM VS UNIGRAPHICS

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ABSTRACT

Nowadays, engineering manufacturing industry and advance manufacturing has been influenced by Computer Aided Manufacturing (CAM). This evolution spark-up new computer software to assist the industry needs such as Computer Aided Design (CAD), CAM and Virtual Computer Numerical Control (V-CNC) software. Numerical Control (NC) plays the major role in attaining command for NC machine in manufacturing industry. The usage of NC machine in fabricating engineering product is increased because it can develop any sophisticated product. In manufacture any engineering product, wasted raw material and high capital cost become the main concern in producing a product prototype. So, this project is mainly to optimize parameter values in fabricating *Sport Rim* product using Unigraphics NX2 software. Microsoft Office Excell 2003 software is used to analyze data pertaining in descriptive statistics that is the change of machining parameter versus to time, in order to get the optimized parameter. At the end of this project, the result using Unigraphics NX2 will be compared with Mastercam 8.1.1 software based on same data and design. The last output is simulation of machine process, *Sport Rim* machining animation using Unigraphics NX2 software and the prototype product with full machining process using the design specification. From this research, it is hoped that future manufacturing engineer can identify the crucial optimized parameters in order to obtain high quality product in minimum time frame.

Keywords: Computer Aided Manufacturing, Computer Aided Design, Virtual Computer Numerical Control.

1. INTRODUCTION

Simulation is one of the way to built the system model which have the similarity with the real world attribute. The usage of Numerical Control code Machine can make the engineering product based on simulation design. For this purpose, with using computer technology such as Computer Aided Design (CAD) and combining with Computer Aided Manufacturing (CAM), it can decrease the problems with producing the optimize parameter value without real machining. Using the Mastercam and Unigraphics software in manufacturing industry give a lot of benefits to the organization because it can decrease the risk in choosing the tools for machining process. With using these software, its also can decrease the cost to prevent the time and source wastage because the choosing tools process are tested using the graphical simulation before continue with real machining process.

2. EXPERIMENTAL DETAILS

2.1. Simulation using Mastercam 8.1.1

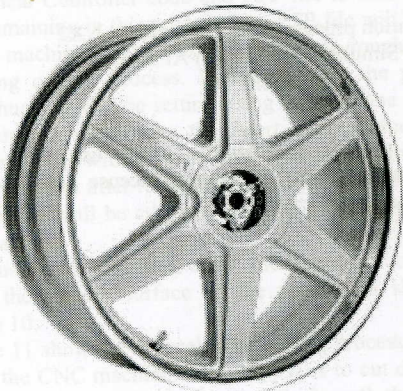


Fig. 1. Real prototype Sport Rim

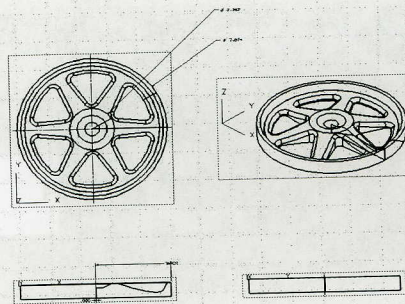


Fig. 2. Sport Rim design

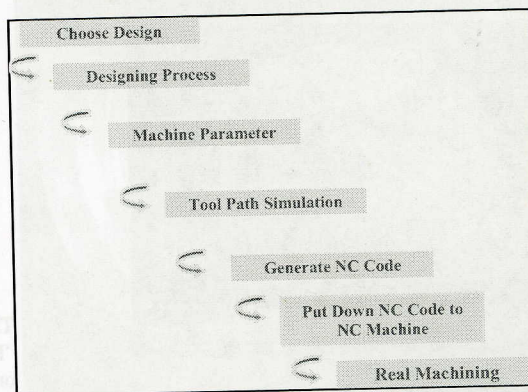


Fig. 3. Methodology

The methodology in Figure 3 was used in this project. The real prototype Sport Rim that is used in this project has shown in Figure 1. This product was modified based on *Sport Rim Racing Hart Type CR* prototype design that is manufactured by Racing Hart Company from USA.

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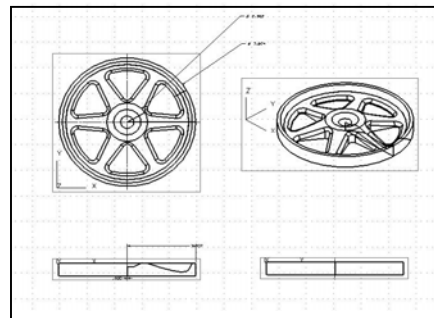


Fig. 2. Sport Rim design

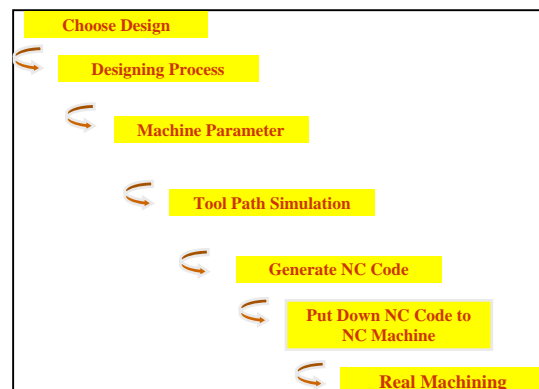


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The methodology in Figure 3 was used in this project. The real prototype Sport Rim that is used in this project has shown in Figure 1. This product was modified based on *Sport Rim Racing Hart Type CR* prototype design that is manufactured by Racing Hart Company from USA. This product was designed in engineer drawing form as shown on Figure 2.

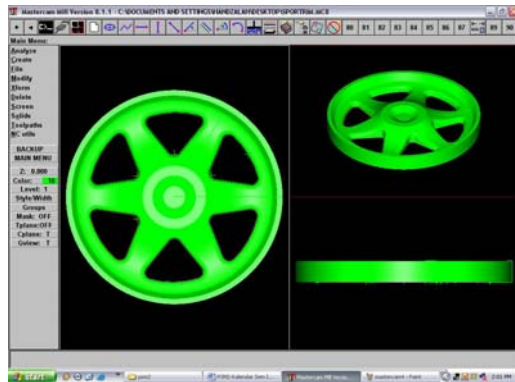


Fig. 4. Designing process using Mastercam 8.1.1 software

Figure 4 above is the designing process interface using Mastercam 8.1.1 software. This product was made from aluminium alloy with 200 mm length and width while the height is 40 mm. To complete the machining process, MAHO 500 E2 machine was used which is made by MAHO Computerized Machine and System. The machining process roughly takes 24 hours which is combined the processes such as roughing and finishing.

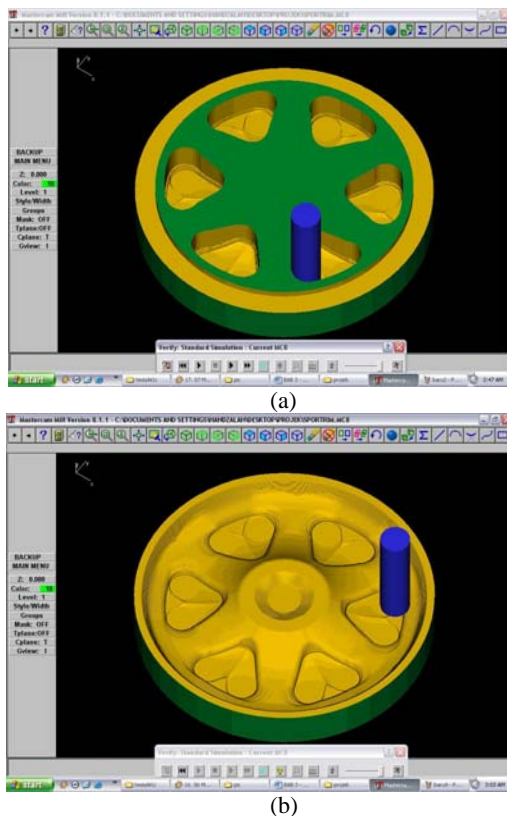


Fig. 5. Cutting simulation process using Mastercam 8.1.1 software: (a) Simulation started (b) At the end of simulation.

After generate the tool path, there are a lot of steps to generate the Numerical Controller code using this software based on tool path verification process.

2.2. *Simulation using Unigraphics NX2*

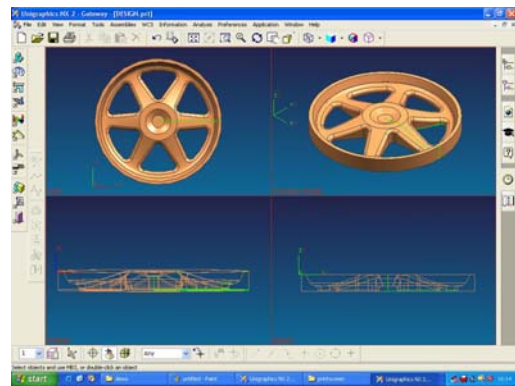


Fig. 6. Designing process using Unigraphics NX2 software

The interface in Figure 6 is the designing process using Unigraphics NX2 software based on Mastercam 8.1.1 software design.

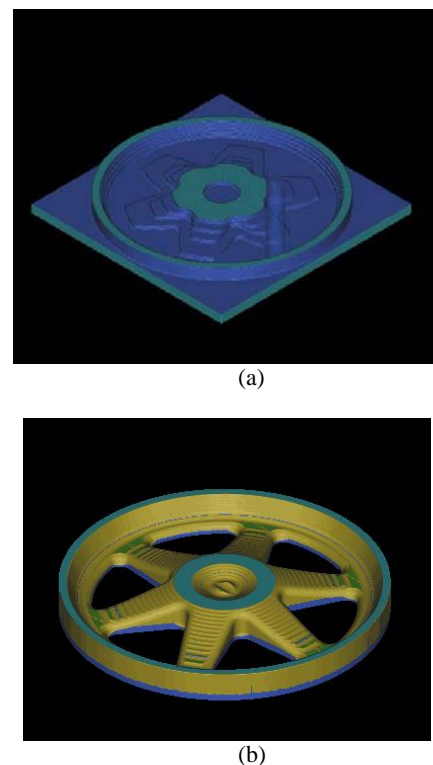


Fig. 7. Simulation process using Unigraphics NX2 software: (a) Simulation started (b) At the end of simulation.

The simulation process in Figure 7 will use the "Philips.exe" compiler from Unigraphics License based on machine tool path verification.

3. RESULTS AND DISCUSSION

3.1. Real Machining



Fig. 8. Machine tools for real machining process

The real machining process will use MAHO 500 E2 Numerical Controller machine. This machine used the machine tools as shown on Figure 8.



Fig. 9. After roughing process

There are 2 process to make this prototype product using MAHO machine : Pre-process and post-process. The machining process based on Numerical Controller code which was generate using Unigraphics NX2 software. The pre-process is the designing process using Unigraphics NX2 software. This process will generate 3 file: CLS file to show all the Automatically Programmable Tools code, PTP file to show all the Numerical Controller code and PTP file to show all the time remaining in this process. The PTP file will be used in real machining. The post-process is the roughing and finishing cutting process. Before activate the process, Jaw Chucking will be setting using the machine spindle. This process will create the Sport Rim product using roughing tools with 0.14 mm/rev feed rate. Figure 11 is the screen shot after roughing cutting process. Normally, this process will be carrying out after work piece sizing process.



Fig. 10. After finishing process

With using the finishing tools, the cutting process will make the smooth surface on the product as shown in Figure 10.



Fig. 11. Manual lathe cutting process

Figure 11 show the manual lathe cutting process without using the CNC machine. The purpose is to cut down the part of the product that is not needed. Overall, there are 4 cutting process to complete this stage : boarder cutting process, center pocket cutting process, hole milling process and surface cutting process. Figure 12 show the product after all cutting process.



Fig. 12. The product after cutting process

4. CONCLUSION

Table 1

Simulation specification.

The time remaining in this process are shown below.

Factor	Units	Unigraphics NX2	Mastercam 8.1.1
Tool size	mm	12	12
Cutting speed	m/min	240	240
Feed rate	mm/rev	700	700
Spindle Speed	rpm	1000	1000
Tolerant	-	spiral	spiral
Time	minute	4.27	7.32

Table 2

Roughing process specification

Factor	Description
Tool size	14 mm End Mill
Cutting speed	70 mm/min
Feed rate	350 mm/min
Spindle Speed	1000 rpm
Time	4 hours 45 minutes

Table 3

Finishing process specification

Factor	Description
Tool size	12 mm Ball Mill
Cutting speed	70 mm/min
Feed rate	350 mm/min
Spindle Speed	1000 rpm
Time	3 hours 15 minutes

From the Table 1, we can see that the Unigraphics NX2 software can make the short simulation time than the Mastercam 8.1.1 based on the same simulation specification. This result can ensure the best software to generate the Numerical Control code which is use in real machining. Using CAD/CAM software like Mastercam and Unigraphics are more efficient than prototype machining without simulation process. Choosing the best parameter is important to prevent the raw material and time wastage. The comparison between Mastercam software and Unigraphics software show that the Unigraphics software is better to generate the simulation and Numerical Controller code. This comparison based on machining method, graphical user interface, user friendly, the quality of product and the time remaining in machining process.

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