Research on Computer Simulation Technology and Application of NC Machine Machining

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Abstract. In order to ensure the correctness of NC machining process, it is very important to verify the machining program before NC machining. At present, the development of computer simulation technology makes the technology of verifying NC machining process in the computer environment widely used in the actual production. Therefore, this paper discusses the numerical control machine tool machining computer simulation technology and application.

Keywords: CNC Machine Tool, Simulation Technology, Application

1. Introduction

Through numerical control machining simulation, the processing process can be displayed in geometric graphics, images or animations, so as to check whether the final geometric shape of the parts meets the requirements. At present, the mainstream CAD/CAM software has numerical control machining trajectory simulation and over-cut, under-cut analysis functions. Can also check the CNC processing process tool, handle and workpiece, fixture and so on whether there is collision interference, and check the movement of the machine tool spindle and machine tool parts, fixture and so on collision interference, so as to ensure that can be processed in line with the design of the parts, and avoid unnecessary damage to the tool, fixture and machine tool.

In recent years, with the development of simulation technology and the needs of actual production, more and more attention has been paid to the analysis of physical quantities such as force and heat generated in machining process. By simulating the physical quantities such as force and heat in the cutting process, the stress state, thermodynamic coupling and residual stress in the machining process can be analyzed, so as to provide a reference for the machining process control and cutting parameter optimization. One of the important purposes of numerical control machining process simulation is to optimize the cutting parameters, that is, through numerical control machining process simulation, to find the problems existing in the existing trajectory and the part of parameter setting to be improved, so as
to optimize the cutting parameters to improve the processing efficiency. In the process of machining difficult material and high precision material parts, the tool wear rate is fast and the tool wear will affect the machining accuracy and the integrity of the machined surface. Therefore, it is very important to predict tool wear in machining process to ensure machining accuracy and surface integrity of workpiece. Among them, the simulation for overcut, undercut and collision interference inspection is usually called geometry and motion simulation, mainly to check whether the geometric quantity and motion relationship in the process of CNC machining is correct. Force-thermal simulation and prediction of tool wear are usually called physical simulation, which is mainly used to simulate the physical quantity in the process of numerical control machining, and can analyze the deformation and quality of the workpiece after machining.

It is these many functions and purposes, contributed to the numerical control machine tool processing in the computer simulation technology and application.

2. Application of simulation technology in NC machine machining

Because of the rapid development of science and technology, NC technology is constantly upgrading, the correctness of NC programs fundamentally affects the quality of products. Most of the time, we have to use the trial cutting method to ensure the accuracy of the NC program, replace the production of the apparatus into a convenient cutting material, using this way, the processing instructions can be comprehensive detection. In NC machining, track display method is often used, but there are shortcomings such as laborious and time-consuming, which can increase the production cost of the company and prolong the research and development time of the products. It is very common to use simulation technology in NC machining. It refers to the process of applying computer man-machine interaction technology and computer graphics to machining by computer simulation of machine tool processing in real work. At present, many schools have added this course in teaching, its establishment can train the school with strong professional ability, thus lay a solid foundation for the student work. At the same time, the company uses this technology in the operation, can better ensure the quality of NC machining products, greatly reduce the production time, enhance the quality of products [1].

3. Introduction to numerical control machining simulation system

3.1. Vericut system

This system is widely used, can simulate the verification steps of NC code, and can improve the ability of machine tool to remove material and cut. Vericut is the simulation software which can simulate the moving track of blanking and cutting, and carries on the reality through the computer, and carries on the test to the precision of the tool track, at the same time, the content after the test can meet the relevant design standard. Before the actual production, the Vericut system can find the possible defects in the processing ahead of time, and list the correct serial number of the machining track at the same time, which makes the modification more convenient and fast. No matter what form of props track code, generally can be used as Vericut input program, and can also run directly into APT form of CL files or M&G code. As with the actual processing, the Vericut will apply to the tool track code and describe the cutting props and materials. On the one hand, the verification process can monitor all the error logs. On the other hand, a three-dimensional solid product model can be obtained, which can be detected or saved as other raw materials.
Vericut can not only simplify and make the verification process more efficient, but also enhance the production efficiency of enterprises. The user can automatically optimize the setting in the use of Vericut, from the cutting angle, width, depth and other aspects, so that all the tool track feed speed and cutting speed to the best state, some can even make the Vericut more personalized settings or achieve tool compensation. Moreover, it can also simulate the combination of turning and milling or wireframe EDM with more than 5 axes or drilling and milling operations. Because of the special module which can enhance the mechanical properties and characteristics, the Vericut has become a omnidirectional simulation, verification and optimization method. This method can better enhance the efficiency of NC machining.

3.2. Machine simulation system

The system is the most convenient and practical for the use and control of machine tools in NC machining simulation software. The main function of the system is to compile the identifiable NC code file and to simulate the machining process of the machine tool through the visualization of the NC code file. The technology is more complex and can simulate the machining coordinate system, tool length compensation, diameter compensation and so on. Before machining, the system can find the hidden problems in the machine tool and workpiece in advance, and find the optimal high speed mode machining track, which is convenient to adjust. The NC code module can find errors in operation and list them one by one in error log file for operator reference. Most of the time, the Vericut system and the Machine Simulation system are combined to make the verification system more comprehensive. In this system, Vericut can simulate the cutting process of workpiece and ensure the accuracy of NC code. Machine Simulation is responsible for simulating the possible problems of machine tool and workpiece in work, thus providing a more comprehensive problem detection system for NC machining process. Greatly enhanced the efficiency of processing. Meanwhile, the Machine Simulation system can also convert a variety of NC codes, which can convert some unusable NC codes into ASC II APT tool path files that can be used. APT tool path files can be used in most general NC machine tools or simulated using Vericut [2].

The system needs to have the function of interpreting NC code through NC instruction, which directly determines that the system can control all the processes of simulation. The software can also provide users with a control file library, so that users can freely combine their own ideal processing system according to their own needs, and can also enable users to compile control files, customize machine tools, and get a better simulation environment. Its functions and modules are as follows:
The NC optimization function includes all the functions of NC verification. And according to the machine speed and feed rate of various materials to improve the NC machining trajectory. Test the impact of the tool handle on the tool root. In order to improve the utilization rate of machine tools. AUTO-DIFF function uses more Vericut components and data differences to compare design models, can quickly identify the simulation and design of the cutting position difference. The function of this function is to test it before processing, to identify possible problems, thus reducing the total cost of NC machining process. AUTO-DIFF can compare the geometric characteristics of adding simulation model to design profile model from CAD system. Comparing IGES exact mathematical description model with the simulation model, Vericut the system can detect more precise problems. After comparing AUTO-DIFF, Can accurately analyze the cutting deficiencies or cutting too many departments. Thus, AUTO-DIFF it can not only reduce the cost and time of production, also increased the quality of the first processing. The Geometry Toolkit module can turn all kinds of CAD data into STL files or CGTech products identifiable files, And can fix some model files with problems. This module enables certain unused or less-used models to be converted into entities such as fixtures, components, etc. that can be used, can even be converted into CGTech products and other applications can use the simulation model. Machine tool builders can provide tools to adjust current control commands to CNC machines, And it can also be used to add new devices according to the requirements of the simulation environment. The digital device can be tested, modified and assembled in visual form under a simple user interface. The entity model can be used in the Machine Simulation system to describe the relevant parts of the machine tool or to add other model to the CAD system [3]. The module can also support some more advanced operations, such as macro instructions, computing length programming, tool length compensation and so on. A machine tool builder can also convert standard ASC II codes into other forms of code, so that some unusable defect codes can be repaired and reused, thus reducing staff time and machine tool use to a certain extent. It is more convenient to upgrade old tool tracks to control / machine tool combinations that meet current requirements than to write old programs again. At the same time, the log file can also show the difference between the previous NC code and the running status after code conversion.

4. Research on computer simulation technology and application of NC machine machining
4.1. **NC programming**

NC machine tool machining simulation technology in the application process to ensure the correct NC program this is mainly because in the production and processing of mechanical parts," easy cutting materials are often used as workpiece test use "in this process" NC machine tool machining instructions are tested, NC machine tool machining simulation technology will also use the method of track display, using pen or needle as a substitute for cutting tools, using cardboard or color plate as an alternative workpiece, This kind of alternative operation demonstration method can simulate the tool motion track in NC machining to form two-dimensional figure and display the machining track in two-dimensional and half-dimensional. The application of NC machine tool machining simulation technology obviously saves the processing material and the processing cost. The simulation technology of NC machine tool machining is mainly to simulate the calculation method of the preliminary machining of mechanical parts [4]." demonstrate the simulation calculation and modeling method of graphic display # in the test link "effectively improve the reality of graphic display.

4.2. **Mechanical and geometric simulation**

In the process of NC machine tool processing, the basic trial production environment will be constructed and studied according to the specific production and manufacturing requirements. The application of simulation technology in the cutting process can simulate the mechanical and geometric parts, mainly because the geometric simulation does not need to consider the cutting force cutting parameters and other physical parameters. The rationality of geometric motion and the accuracy of program system are guaranteed in tool and trajectory simulation. In the application practice of NC machine tool machining simulation technology, it can simulate and demonstrate the environmental state and basic flow of NC machining to prevent the fixture from being destroyed, parts scrapped or tool broken due to improper operation procedure. At the same time, NC machining and parts manufacturing can further shorten product design time and product manufacturing time, reduce cost and improve output efficiency [5]. The simulation technology of parts cutting in NC machine tool has realized the simulation of mechanical...
principle "according to the dynamic characteristics" to predict the cutting parameters, tool vibration and
breakage, so as to optimize the whole cutting process [6].

4.3. Product quality aspects

CNC machine tool machining simulation technology in practical application of the tool motion state and
trajectory correctness has an important role in ensuring the quality of NC machining products, this is the
CL data simulation technology. And the simulation technology of CL program can not only carry out
necessary technical training for operators in practical application, but also optimize the degree in
collision inspection [7]. The CL instruction in the CL program is to drive the motion form and motion
state of the NC machine tool, so the application of this machining technology can ensure that the whole
process technology is more close to the reality. The influence of machining environment is fully
considered in NC machine tool processing, but to some extent, it also increases the difficulty of product
processing [8]. Because NC machine tool machining simulation technology is mainly used in tool
trajectory simulation, the application efficiency of NC equipment should be optimized and the product
quality should be considered for parts machining below three coordinates. Improve the application utility
of NC machine tool machining simulation technology [9].

5. Conclusion

By using the simulation method, the whole process of cutting and cutting can be simulated on the
computer, and the problems that may be encountered in the cutting process can be directly observed and
adjusted without actually occupying and consuming the resources such as machine tools and workpieces
[10]. In addition, computer simulation technology can be used to estimate the numerical control
machining results in advance, statistics of various processing data and optimization of the processing
process, to achieve intelligent processing.

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