Virtual simulation of Lathe Machining Training Based on Unity3D

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Abstract. In this paper, through the use of SolidWorks three-dimensional software for the lathe three-dimensional modeling, the lathe three-dimensional model can more intuitively express the structure of the lathe. Through the analysis of the reducer shaft, this paper developed the machining process, and then the solid modeling of the shaft, and finally through the Unity3D software for the reducer shaft machining simulation analysis.

1. Introduction
Engineering training is a basic course of mechanical specialty, of which lathe processing training is an important part. However, due to the large number of mechanical students in the University, the number of machine tools in the University factory is indeed limited, and there are some unexpected risks in many elementary training of lathe workers. Therefore, it is necessary to develop a virtual simulation system to assist lathe machining training[1-3].

In this paper, a virtual simulation system for the training of lathe workers is studied. In this system, students can simulate the machining process of parts through software and get familiar with the machining process. In this way, the busy situation of internship in the workshop can be reduced. Relying on such virtual reality software, the precision work practice can be divided into two parts. First, let students simulate the processing process on the software, be familiar with the whole practice content such as processing technology, and then go to the workshop for field practice, so it is very efficient to carry out the lathe processing training in batches[4-6].

2. 3D modeling of lathe based on SolidWorks
In this paper, the process analysis and three-dimensional modeling of the two-stage reducer shaft are carried out, and then the simulation analysis of its processing is carried out through the software. Through this example, the importance of virtual simulation of lathe processing training is demonstrated.

We need to work out the processing technology first. This stage is divided into three stages: rough machining stage, semi finish machining stage and finish machining stage. In the rough machining stage, simple machining is mainly carried out for the blank, and the rough machining stage is mainly realized by simple rough turning or rough milling. For castings and forgings, the machining allowance is generally about 3mm. Through the reasonable division of the processing stage, we can achieve the best processing of the parts, which can not only improve the production efficiency, but also ensure the quality of the parts processing. This time, it mainly divides the processing stage of reducer shaft, which is mainly used in lathe processing, and the bridge part is mainly processed by washing machine.
Then, we use SolidWorks 3D software to model the reducer shaft. The 3D model is presented in front of us, which can more intuitively express the shape of the parts. Through the software, we can set the density, automatically calculate the volume and weight of the parts, and carry out force analysis, which is very convenient and fast. The following is the detailed 3D modeling of the reducer shaft[7-9].

![Lathe assembly model](image)

**Fig. 1 Lathe assembly model**

3. **Process realization of lathe machining example**

In this paper, the reducer shaft is analyzed as a machining example. The shaft of the reducer is produced in small batch and is mainly used in the transmission system of the secondary reducer. The key slot 10 is used to fix the transmission gear and the key slot 8 is used to fix the output pulley. The shaft adopts 45 × quenching and tempering treatment 230-235hb to meet the high torque requirements of the output shaft. The two-stage reducer is widely used in the production practice, with low price and excellent performance, and has been loved by users.

In this paper, the two-stage reducer shaft is taken as the research object to carry out process analysis and three-dimensional modeling, and then its processing is simulated and analyzed by software. Through this example, the importance of virtual simulation of vehicle training is demonstrated.

According to different parts, the processing stage is generally divided into rough machining stage, semi finishing stage and finishing stage. In the rough machining stage, simple machining is mainly carried out for the blank, and the rough machining stage is mainly realized by simple rough turning or rough milling. For castings and forgings, the machining allowance is generally about 3mm. Through the semi finishing stage of processing, the surface tolerance level can be achieved, and the surface roughness can be achieved. Finally, through the finishing stage, which is also the final machining of parts, the machining accuracy can be achieved, and the surface roughness can be achieved. Through the reasonable division of the processing stage, we can achieve the best processing of the parts, which can not only improve the production efficiency, but also ensure the quality of the parts processing. This time, it mainly divides the processing stage of reducer shaft, which is mainly used in lathe processing, and the bridge part is mainly processed by washing machine.
4. Virtual simulation of lathe machining

At the beginning of production, we need to import the model built by 3dsmax into our Unity3D engine folder. U3D is a development engine with very strong compatibility. It has simple operation and strong compatibility. The models he supports include FBX, Max and other model formats. After the preparation work is done, we need to drag the model. In the 3D engine, we just need to drag the model from the folder and into the scene. In order to make the model have a physical effect, I need to add a rigid body and a collision body in the model panel, and set the size of the collision body. Adding a collider and a rigid body in the engine is equivalent to adding objects Li, with these two controls, he can simulate the collision in the real environment in the 3D engine, so that he will have a collision with the ground. Produce a real collision. In order to make the model more beautiful in the scene, I added a point light source in the scene to directly illuminate our model. As shown in Fig.3.

In order to make the project more beautiful, I want to have a UI display at the beginning of the project, and the display is a gradual display, from the beginning of black to colorless slowly.

(1) Create UI

We need to create a UI. First, we need to create a canvas, then create an image, create a text file, display the text through the text file, and the image displays the black background.

(2) Script

This function is mainly created by scripts. First, we need to add a cavasgroup control to our image, and then set the control by setting the alpha value in the control, so as to change the transparency. This function is mainly completed by timers. We want to reduce the transparency with the world. This is mainly through timers.

Camera roaming is a function that allows the camera to rotate around our model. However, our mouse can also control the rotation. The realization of this function is to first obtain the position of the model, and then set the rotation through rotatearound in U3D's own API. After the setting is completed, we need to obtain the X-axis and Y-axis of the mouse click Offset.
5. Conclusion
In this paper, a simulation project is developed based on the NC and simulation projects. The 3DsMAX is used to model the NC lathe. Then this article uses the Unity3D engine to carry on the development to the model one simulation class numerical control project. Users can view the PC, Android and IOS end-to-end pairs exported by Unity3D and the CNC lathe at 360 degrees. This can solve the convenience of daily life that we need to make on-site investigation. Through this project, we can observe the specific content of the lathe system without you, which is very convenient for customers to watch. Using Unity3D engine to realize virtual simulation operation and machining of lathe is described, and the key technology to realize virtual simulation machining and measurement of lathe is described.

According to the course planning during the university period, the actual operation such as metalworking practice must be carried out in the workshop of the school factory. Only the actual operation can be familiar with the performance of the machining machine tool. However, the limited number of machine tools is difficult to ensure that the students have enough practical operation. There are many mechanical students in the University and the number of machine tools in the school is very limited. Therefore, the actual operation is carried out before the operation and processing of machine tool, the virtual simulation operation and processing can effectively solve the problems of insufficient machine tool equipment, heavy training workload and high training cost.

The simulation system takes CA6140 lathe as the prototype to simulate the processing of reducer shaft parts, including shaft clamping, tailstock positioning, turning tool feeding and many other steps. The shaft is mainly used in the transmission system of the secondary reducer. The key slot 10 is used to fix the transmission gear and the key slot 8 is used to fix the output pulley. The shaft adopts 45x tempering treatment 230-235hb to meet the high torque requirements of the output shaft. Through the analysis, the processing technology is established, and the axis is processed by solid modeling and simulation.

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