

## The study on industrial modeling design based on Rhino 3d

Rao Shun <sup>1, a</sup>, Liu Jing <sup>2, b</sup>

<sup>1</sup>Jing De Zhen Ceramic Institute, Jingdezhen, 333000, China

<sup>2</sup>Sub-Institute of Science Technology and Art Jingdezhen Ceramic institute, Jingdezhen, 333000, China

<sup>a</sup>21605511@qq.com, <sup>b</sup>1026610646@qq.com

### Abstract

**NURBS is a very good modeling method. Based on Rhino 3d, applications of industrial product modeling are developed in this paper, and a more efficient and perfect industrial modeling model building method is explored in the surface functions of Sweeping, Skinning, Extrude Surface under 3D Rhino platform.**

### Keywords

**NURBS; surface; industrial modeling; Rhino.**

### 1. Introduction

Rhino 3D is a NURBS modeling software, which is easy to operate, has an open platform, and admits users carry out secondary development, customize, increase and extend its function, that is convenient for the realization of industrial modeling function, and also enriches the operation method of industrial modeling. NURBS is a modeling method to generate surface object, as an excellent modeling method, which can create a realistic, vivid modeling in the computer. The introduction of NURBS method has greatly enhanced the surface modeling function of CAD/CAM system, therefore, it has been increasingly widely used in various fields. At present, industrial manufacturing has selected NURBS as the main method of geometric description, NURBS has become the basic geometric expression of many CAD/CAM systems and the international standard for data exchange.

### 2. NURBS function application of Rhino 3d

NURBS is now being used in large-scale 3D software, because of the unique advantages, it not only has become an indispensable technical means for aesthetic appearance design, but also can express a variety of complex geometry and surface modeling, such as industrial products for daily industrial use, streamlined sports car, biological models, people's physical characteristics, etc.. Base on the NURBS free surface modeling function, curves and surfaces are used to represent contours and shapes in internal building space, so as to provide excellent data and form for the final industrial products or works of Art.

NURBS powerful surface modeling system has good basic functions of Sweeping, Skinning, Revolve surface and Extrude Surface, and connection, pruning, deformation, simplification can being conducted between surfaces, these functions can be very good to express the ideal three-dimensional model. In the software, the model can be repeatedly modified to establish data or parameters and achieve a sense of reality through the built-in lighting simulation system, which have played an important role in the completion of the product in the later period. In Rhino 3d, the required 3D model, especially for the generation of various complex surfaces can be established through the operation of the NURBS command in the menu interface left palette tool. Its value lies not only in the high degree of freedom of the design and efficiency, but also in the top surface model can being input to other CAD/CAM software to carry out the numerical control data output or high quality rendering.

### 3. Modeling advantages of Rhino 3d

In industrial modeling design, the composition of curves and surfaces is an indispensable means of expression and application form in industrial design, for the design of curves and surfaces can make modelings have a sense of rhythm, and the streamline design can not only make people feel pleasure and comfort in the experience of contacting with goods, but also present the characteristics of movement and life. Using NURBS modeling method to construct industrial products can play a convenient and quick action. Computer aided design with 2D or 3D space for real simulation, before making the real model we can create the initial program and complete it within a relatively short time, use the history functions to repeatedly modify and observe the model style, comprehensively show the real effects of industrial modeling, give different material & texturing for industrial products, etc.. Rhino 3d free-form surface is mainly presented in visual mode, and uses digital new method to express ideas and originality. Although it does not construct the real physical model, but it occupies too many advantages in program implementation and rapid expression, and plays a huge role in our ideas formatting and conceiving stage, which greatly improved the quality and efficiency of the design.

### 4. Industrial modeling design case study

NURBS model building, with points forming line, and the motion connection between lines forming surface. Industrial modeling appearance is made up of the most basic elements--points, lines and surfaces, which not only include abstract concept elements in industrial modeling, but also contain specific visual elements. The following will introduce a representative camera.

#### 4.1 Import surface and place

In rhino 3D, we can make use of the background reference for modeling, and drawing in the graphic software, with the drawing basis being from preliminary design of the scheme conception, which can choose the front perspective and other import perspectives, and the pictures are placed by using the importing pictures function. The importing function of Rhino software is to determine the needed 3D surface data, and placed in the correct position. Finding out the focus point of the surface and heel heart position to determine the surface contour, proportion, and place surfaces in the correct position, which is convenient for drawing style line and building models in the surface, as shown in Figure 1, the sketch of placing camera.

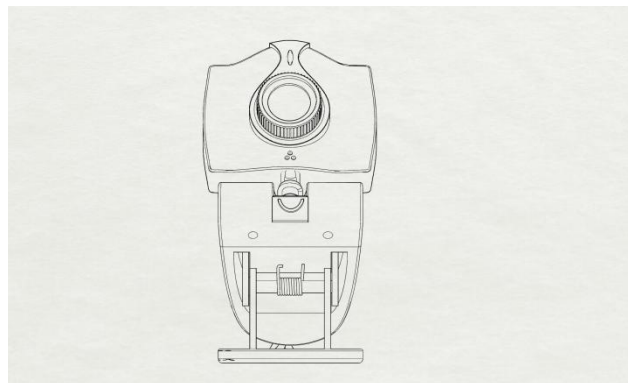


Figure 1. The sketch of placing camera

#### 4.2 Drawing curves on a surface

Using rhino 3D curve drawing function to draw the shape outline curve in the front view of the curve, and project the style line to the surface through projection tool, then the figure 2 camera main body modeling will be obtained. By using the surface function of Sweeping, Skinning, Extrude Surface, the drawn line style will be attached to the surface based on surface as a benchmark, the subsequent model patch will also be fully affixed to the surface, keep in line with the real modeling.

### 4.3 Model upper building

Rhino 3D software can be used to generate different model upper patches through the style line, and make the slices have layers according to the thickness of the real modeling material bias modeling upper patches, formatting the effect of overlapping with the true shape, so as to make different layers and colors represent different model patches, which is easy to realize the follow-up operation.

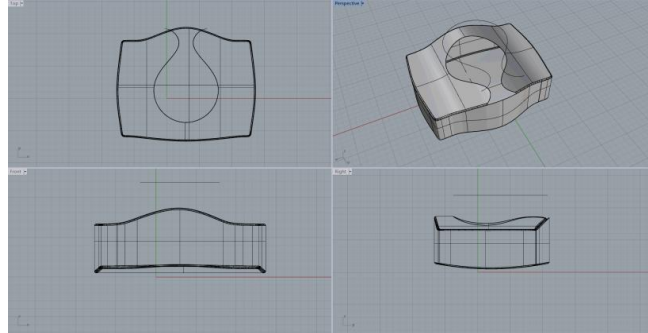


Figure 2. Camera main parts

### 4.4 Up and down main parts building

According to the true appearance modeling, the camera body, bracket, wire and other components are set up. Through the rhino powerful surface editing function, it is first to set up the camera plane effect, then adjust the model curvature to make the text symbols perfectly fit in the model surface. Because of the bracket lying in the bottom of the model upper, the curve can be directly pull out, then the support thickness will be obtained by conducting offset and other operations. Rotating shaft, with the corresponding size, will display the rotation effect in the corresponding position according to the real spring size. The operation effect is shown in Figure 3.

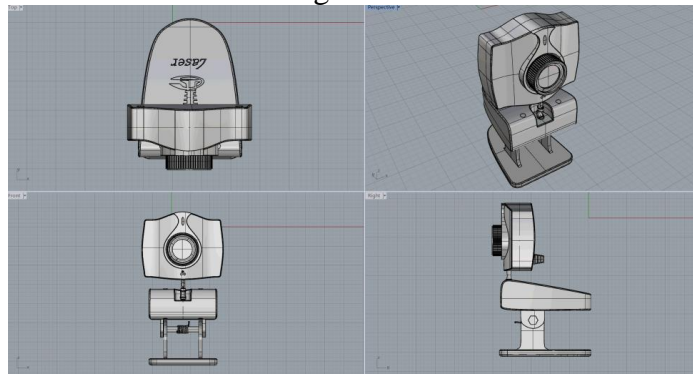


Figure 3. Completing model building

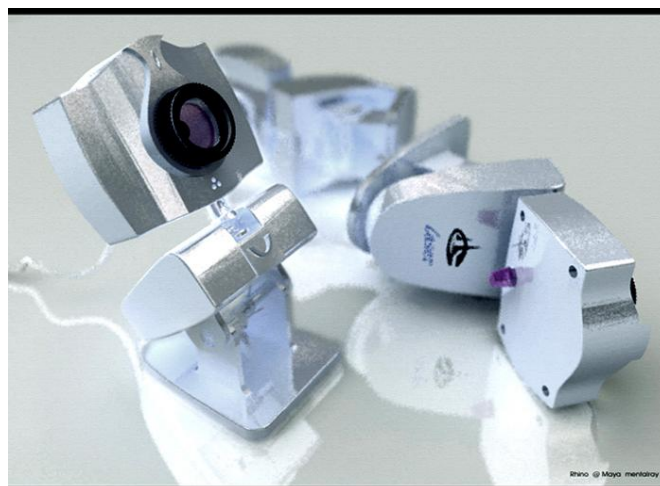


Figure 4. The final renderings

#### 4.5 Modeling rendering

Finally, we can conduct later coloring for our camera scheme. The built-in rendering module in rhino 3D is not very ideal, but it has a powerful third party rendering plug-in module, thus we can use keyshot or Vray for rendering at its interface, selecting specific material properties and making the real effect of photos. As shown in Figure 4, with these basic, we can have a real reference sample in the design and finally save time and cost.

#### 5. Summary

In the era of modern science and technology rapid development, industrial design enables us to give it new meaning. We can carry out thorough research on the characteristic of the industrial modeling through new scientific and technological means, grasp and control the various links of modeling design combining with computer. Meanwhile, in the course of study and practice, we must be familiar with the surface model making method of 3D Rhino, reasonably use the design software for more convenient and efficient industrial design, to further promote the industrial modeling design of digitization and standardization, so as to further improve the digitization, standardization of industrial design and improve the efficiency of R & D of industrial products.

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