Parametric Design of Car Rear-View Mirror Surface

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Abstract: The parametric design of curved surfaces has gradually emerged and penetrated into the field of industrial design. In the automotive field, the parametric design of the curved surface can be applied well in terms of the design of the car mirror surface. In order to improve the design level and quality of the rear-view mirror, a redesign method based on the forward and reverse two-way hybrid design idea is proposed to realize the parametric design of the car rear-view mirror surface. Starting from the parametric design related applications of the surface, the implementation of the parametric design of the car rear-view mirror surface is introduced in detail. The application of the example shows that the car's rear-view mirror surface parameterization method has a good performance in the development speed and quality of new products.

1. Introduction

Surface parametric design is widely used in traditional manufacturing industries such as automobiles and aerospace, as well as in daily consumer electronics. In the automotive field, surface parametric design can be well applied to the construction of automotive rear-view mirror models. However, the curved surface products such as automobile rea-rview mirrors are more complicated. The traditional one-way model construction method is difficult to meet the needs of today's rapid development. Based on the advantages of forward and reverse modeling, the innovative two-way design method is used to realize the automobile. Parametric design of the mirror surface. In this paper, how to implement the parametric design of the car rear-view mirror surface for this forward-reverse two-way hybrid design method is introduced and explained in detail. And, in practical design applications, this method performs well in new product development.

2. Surface parameterization design application introduction

The parametric design of the surface has greatly improved the graphics modification and can effectively improve the flexibility of the design. The parametric design of the surface has been fully penetrated into the field of industrial design. It has very high application value in conceptual design, solid modeling, assembly, dynamic design, mechanism simulation, tolerance analysis and synthesis, and optimization design.

Research on parametric design methods has become a focus, hotspot and key topic in the development of CAD software. As far as parameterized common software is concerned, the mainstream parametric design application software has four major softwares: UG, CATIA, Pro/E, and Solidworks. At the same time, these four softwares have their own characteristics, occupying their respective fields in different related fields. Market share. Among them, Pro/E is the beginning of parametric design. Parametric design is first realized by Pro/E. Due to the outstanding performance of Pro/E parametric design, it quickly grabs some market share of traditional CAD software giants such as UG and CATIA. The field applications mainly focus on daily necessities, small household appliances, consumer electronics, engine design, etc.; UG, CATIA two leading companies to catch up, also developed a parametric design function, from the current situation, its application in the traditional manufacturing field More extensive, such as automotive, aerospace and so on.

In terms of mold design, the basic structure of most parts is very similar, but the shape and related dimensions are slightly different. For these parts, through the specification, serialization and

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integration of the system, and then rely on the parametric design system, design The person only needs to input the relevant parameters to automatically realize the parameterized design and generate the assembly drawing and the zero map. However, for a component without a related mold, how to construct a three-dimensional model of its external dimensions and realize the parametric design of the surface? Now we will discuss how to realize the parametric design of automotive rear-view mirrors.

3. Parametric design of car rear-view mirror surface

The car rear-view mirror is a complex, classic free-form surface part, and also an important component of the car. Its new product development focuses on reducing the resistance and achieving a beautiful appearance. Such curved surface products are more complicated, with some simple features and free-form surfaces. If the model is built directly in the traditional and conventional forward design, the actual operation process is complicated, the program is cumbersome, and it takes time and effort. Inefficiency; if only the reverse model is used to construct the CAD model of the car rear-view mirror, it lacks new ideas and it is difficult to reflect the artistic concept. Therefore, whether it is reverse design or forward design, a single method cannot meet the needs of rapid development. If the respective design advantages of the two are used and combined with each other, relying on the reverse technical data measurement and processing functions, the key index parameters of the automobile rear-view mirror prototype are obtained, and combined with the forward design concept, the surface design, feature modeling and parameters are performed. Adjustments, which can not only design more beautiful and meet the specific functions of the rear-view mirror products, but also accelerate the product model building speed and shorten the development cycle of new products.

Based on the actual engineering case, the practical application of the forward and reverse hybrid design concept in the development of new automotive rear-view mirror products is discussed. The process is as follows: First, the point of obtaining the prototype surface of the rear-view mirror using the 3D scanning system Cloud data, preprocessing at the same time; second, analyzing the design concept of the original product of the rear-view mirror, extracting the required curves and surfaces and reconstructing the model; third, importing the reconstructed data into the forward design software, and then Based on the customer's requirements and conceptual design, the forward design is carried out to realize the parametric design of the car rear-view mirror surface.

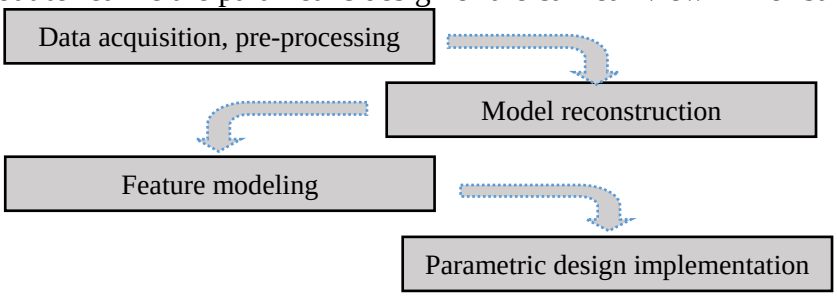

Fig.1 Parametric design of forward and reverse hybrid surface of automobile rear-view mirror

3.1 Data collection

The key to the effect and speed of the reconstruction model is whether the measurement data is available. Therefore, the efficient and scientific and high-precision data acquisition of the prototype surface of the automobile rear-view mirror is the basis and core link for the construction of the forward and reverse hybrid model. Taking full account of the surface complexity of the rear view mirror of the car, the parametric design of the car rear-view mirror is based on the 3D scanner Rexcan III measuring device. The device is equipped with a dual lens and has high resolution and has the following advantages. High resolution, dual lens with multi-grating transmission technology, resolution up to megapixels; second, high precision, data measurement accuracy can achieve 0.01mm level; third, high automation, automatic integration of marker points, unified The complete,

three-dimensional point cloud data can be automatically generated; four, high-speed calibration, advanced calibration system, the entire calibration process can be completed in a few minutes.

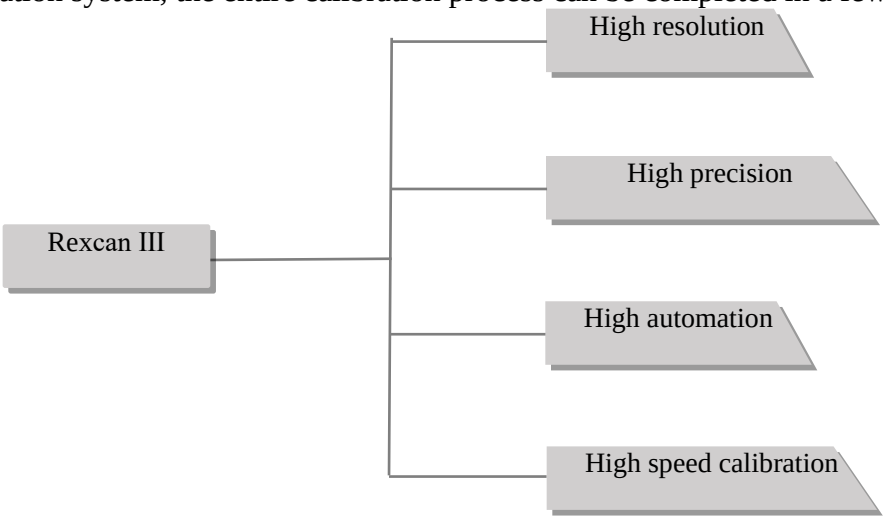

Figure 2 Advantages of the measuring device Rexcan III

In order to collect accurate and complete measurement data, measurement planning before measurement is essential. Measurement planning is to achieve the availability of measurement data and avoid the use of non-use phenomena. In the actual data measurement process of the car rear-view mirror, the following principles must be adhered to:

(1) The principle of comprehensiveness. In order to ensure the integrity of the surface data, multi-angle and all-round shooting of the rear-view mirror prototype is required, and the measurement area should be partially overlapped;

(2) The principle of targeting. Since the entire curved surface is composed of a plurality of patches, the patches are connected to each other by rounded corners or transition sheets. Therefore, the measurement is based on the product's modeling scheme, and the patch is divided reasonably, and the geometric information of the prototype is fully excavated in a more targeted manner;

(3) The principle of accuracy. When measuring the boundary of the surface, the measurement direction needs to be consistent with the normal surface of the measurement surface. At this time, the measurement error is the smallest and the measurement data has the highest accuracy.

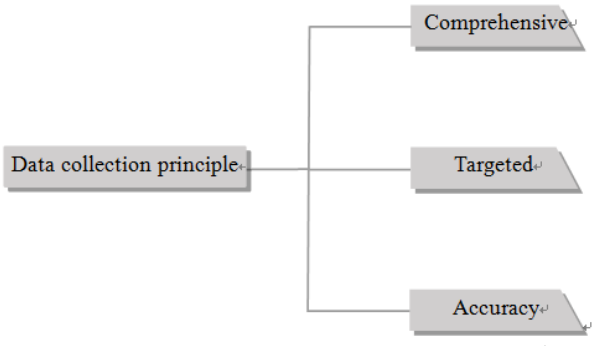

Figure 3 Data Acquisition Principle

3.2 Data pre-processing

The pre-processing work needs to be completed before the prototype reconstruction, data smoothing of the measurement data, multi-view point cloud alignment positioning, data reduction, etc., in order to obtain correct and complete measurement data, so that the subsequent parametric modeling work can Orderly. Among them, data smoothing: by eliminating the noise of the measured data, in order to obtain more accurate data and better feature extraction; multi-view point cloud alignment positioning: based on the measurement planning principle, the prototype geometry interference is taken into account, Through the coordinate alignment processing and the Boolean summation, the data object is unified; the data is reduced: the additional features of the mirror

surface are less, and the curvature changes are gentle. It is necessary to remove the redundant data point cloud automatically by using the specified point cloud density. Remaining processing.

3.3 Surface reconstruction

At present, the free-form surface modeling methods mainly include rectangular domain parameter surface fitting methods based on NURBS surfaces and surface construction methods based on triangular Bezier surfaces. Among them, the former method, the description method can realize the unification of the curved surface, and the shape of the curved surface is flexible, convenient, and stable in calculation.

The parametric design of the rear-view mirror surface is oriented, and the product requirements of the rear-view mirror are oriented. The four-domain surface reconstruction scheme based on NURBS surface is adopted. First, the data point cloud obtained by the Rexcan III measurement system is read by the dedicated reverse software Imageware. Secondly, the composition and properties of the product line and surface are analyzed. The B-spline curve is fitted to the grid surface by the type points, and the corresponding curves are respectively intercepted for the large-surface modeling of the rear-view mirror, and the curve is used. Based on the contour, it is cropped; in addition, NURBS surface fitting is performed by four smooth curves, and the fitting quality of the surface is tested by calculating the distance from each point in the point cloud to the surface to adjust The control point method controls the reconstruction error so that the surface is close to the point data until the specified accuracy is met. Finally, through a series of methods such as surface cropping and merging, a complete, high-precision car mirror housing surface is obtained.

3.4 Feature Modeling

Both Imageware and NX are the main products of EDS, and the data compatibility is relatively good. Therefore, the NX CAD module is used to perform 3D solid modeling of the car mirror surface. The above-mentioned surface file (IGES format) is imported into the software NX, and the mirror surface modeling process is performed. In the whole process, the surface part or the whole can be modified appropriately, so that the product design function is more perfect and the appearance is more beautiful. In the actual parametric design operation, the structure can be further improved according to the specific requirements of the customer's function, and the inner column, the buckle or the function hole can be added, and finally the new product solid model is obtained.

4. Conclusion

Based on the professional software platform, this paper explores the rapid development of new products for automotive rear-view mirrors, and innovates a forward-reverse two-way hybrid design method to realize the parametric design of automotive rear-view mirrors. The application example shows that the method combines the advantages of forward and reverse product design. The reverse design transforms the product entity into various parameters. The forward design makes modifications and innovations to the physical model, which improves the redesign ability of complex parts to some extent. Can significantly improve the competitiveness of products.

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