

Simple Applications of Solidworks in Design of Products

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Abstract:- Based on Solidworks, explain some simple applications of software Solidworks in design of a new kind of umbrella though an example. Modeling with Top-down method and assembling them into virtual machine, then, using the motion simulation to check motion interference can reduce the design errors. Use the software of Photoview 360 and Solidworks to complete the industrial design. In the end, completing the entire toy product design process by Solidworks 2D engineering drawing module processing drawings

Keywords:- Solidworks; Top-down, Product Design; Simulation; Photoview 360

I. INTRODUCTIONS

Solidworks, a computer-graphics aided three-dimensional interactive application which is developed completely based on Windows, is currently one of the mainstream computer-graphics aided softwares^[1] and it includes a variety of modules, such as CAD, CAM, CAE, etc. Conforming to graphical interfaces and shortcut operation of windows, it not only provides conveniences for many engineers and technicians to master and use in the aspect of 3D modeling, but also greatly helps to shorten the learning cycle so as to reduce the costs of human resources. With multinational standard parts and open secondary development environment, Solidworks can actualize multiplayer design by using PDM and provide the function of advanced parametric modeling. The features of relational designs can lead to the changes of manufacturing drawings according to the diversification of the models so that it can greatly improve the drawing speed of 2D drawings, reduce errors, shorten the development cycles and lower the development costs. All the things that mentioned above make sure that the new products can be put on the market as soon as possible to improve the competitiveness of the company. This thesis takes the umbrella as an example to introduce the application of Solidworks in the product design, especially the top-down design method.

II. UMBRELLA DESIGN

The traditional umbrella design is still adopted the method that combines the two-dimensional drawing and manual model. Figure 1 is the umbrella model made by the traditional method, the design of which always cannot accurately express the conception (idea) of innovation. With the development of technology, the umbrella is developing from the one with traditional appearance and pure mechanical status to the new interactive umbrella integrated with optical, mechanical and electronic functions. For example, Figure 2 is a remote-controlled aircraft umbrella. To complete the design of this complex umbrella, it is required for new design methods and new design tools. Adopting 3D software to design the umbrella has become an important trend of modern umbrella design. It can use the entity, the surface and other parametric tools of Solidworks software to model the umbrella with

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Top-down method to speed up the design. And then, use the built-in simulation plug-in Solidworks Motion to finish the movement imitation and design optimization. Meanwhile, the powerful plug-in support functions of Solidworks can help complete the industrial design of the umbrella with Keyshot rendering software. At last, draw up the drawing according to the short-cut engineering drawing module standard in Solidworks. The whole process is interrelated without interruption. During the design of the umbrella, these simple applications of Solidworks can be completely qualified for the study on the new and complex umbrella design.

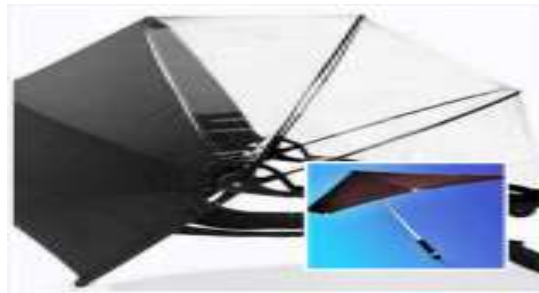


Figure 1 the 3D model of the traditional umbrella

Figure 2 The modern new interactive umbrella

2 The top-down design method of the umbrella

Currently, the common mechanical design methods are the traditional 2D and modern 3D. The modern 3D includes two kinds of design methods: bottom-up and top-down. The above design methods all have its advantages and disadvantages and in different periods each plays a different role.

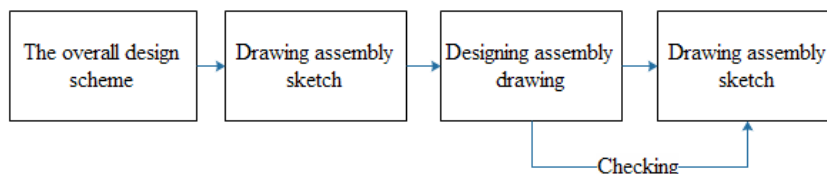


Figure 3 the flow Figure of traditional 2D design method

2.1 The comparison of the three design methods

With the popularity of the 3D design method, the traditional 2D has gradually been eliminated. Table 3 shows the flow Figure of the traditional 2D design method.

As Figure 4 shows, in all 3D design methods, the bottom-up design method is the most widely used. However, this kind of design method also has its disadvantages. For example, interference easily appears during the process of parts assembly. Assembly is very complex and time-consuming. What's worse, it can't make good use of the parametric correlation feature of Solidworks to do some work such as repeat location dimension and checking so that most time is wasted.

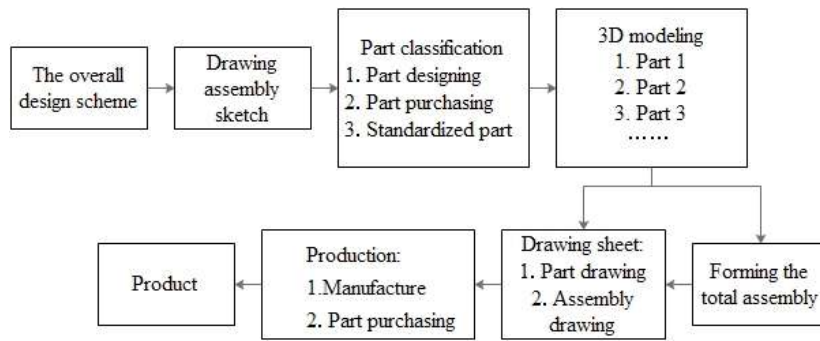


Figure 4 the flow Figure of bottom-up design method

In the Solidworks assembly environment, the existing model dimension can be used by adopting the top-down design method to achieve relational design and linking dimension, which will greatly reduce the frequency of location dimension and checking so that time can be saved. In the meanwhile, this kind of design method enables the designers to consider the design process from overall rather than limit to one part. Thus the designers can pay more attention to the design itself.

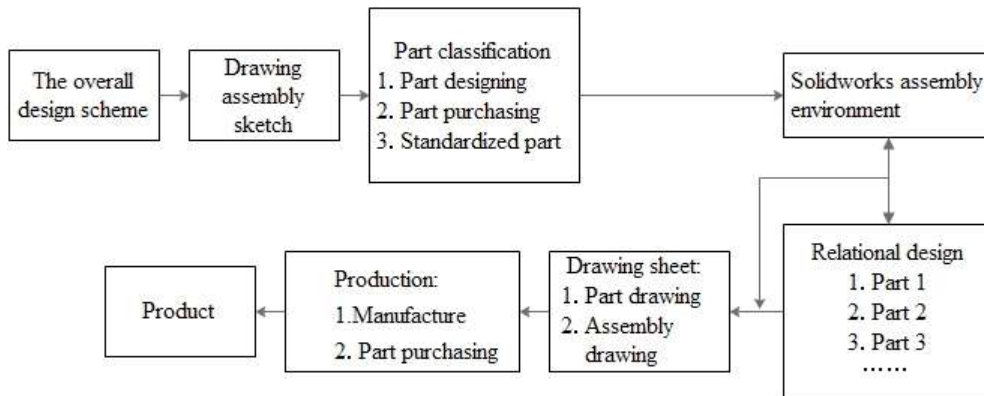


Figure 5 the flow Figure of top-down assembly method

Even though there are some design problems in the later stages, since correlation dimension has been established between the parts, if the dimension of one part is changed, the dimension of other parts related to it will also be changed, which will reduce the missing problems during later modification. In the meanwhile, correlation dimension can be cancelled by hand so that the flexibility of modeling of Solidworks can be greatly used. Figure 5 is the flow Figure of top-down design method.

2.2 The top-down design method

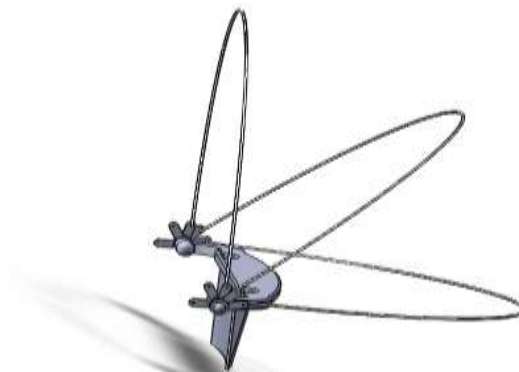



Figure 6 Basis reference in assembly environment

A primary basis reference should be established before adopting the top-down modeling method, then a new assembly should be built, in which inserts the primary basis reference so as to provide reference dimension for the new parts to be inserted. Here the designer takes the design of a backpack umbrella for an example. As the Figure 6 shows, the shouldering serves as a reference. Click "insert—parts—new parts" in proper order.

Select "new part"  新零件 in Feature Manager. Then select "edit" by right-hand button. When entering the assembly parts editing environment, the basis reference turns into transparent mode.

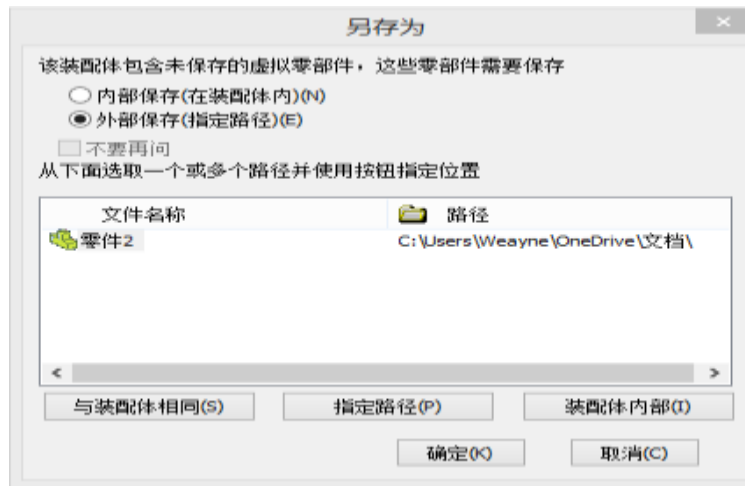


Figure 7 the external storage of new parts

Then draw sketch according to the modeling method in the part environment. Establish a new part by stretching, cutting, etc. Finally exit new parts editing. At this moment, a new part is inserted into the assembly. It should be noted that this new part is not the one existing in the external file but the one still exists in the assembly. Then save it according to options showed in Figure 7. Select the path to achieve external storage so that a separate file is created.

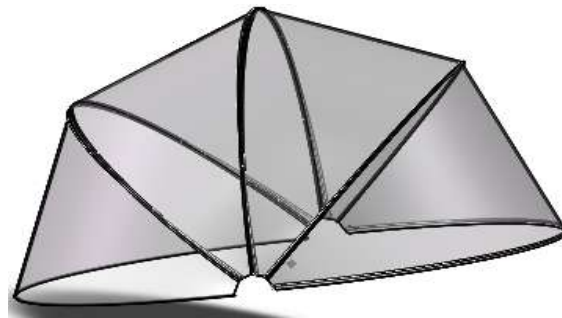


Figure 8 the insertion of new parts in assembly



Figure 9 the 3D model of backpack umbrella

Figure 8 shows that a new part (umbrella fabric) is built by adopting the top-down design method. The edge can fit the support frame arc well. But if conventional modeling and assembly method is adopted, the profile curve of the edge should be drawn by hand to build umbrella fabric, which not only increases the difficulties of drawing sketch, but also makes it difficult to fit the support rack well. Thus the top-down modeling method can simplify the modeling process, reduce modeling time and ease workload of design.

In like manner, model the whole umbrella according to the method mentioned above. Figure 9 shows the final model of the backpack umbrella.

III. THE MOTION SIMULATION OF THE UMBRELLA ORGANIZATION

After the modeling, the motion simulation can find the design mistakes immediately to achieve the purpose of optimum design. Before the motion simulation, all cooperative relationship should be partly mended, such as deleting or compressing the fixed mode of the parts that need to move, those parts need mutual movement should be changed from incidence relation to distance matching relation, etc. Then set value in Motion Studies to achieve the mutual movement of two parts. This passage mainly operates the motion simulation of opening the umbrella which is showed in Figure 9. Click “Motion Studies” in the lower left corner of the interface, add motor, select rotary parts and set the speed.

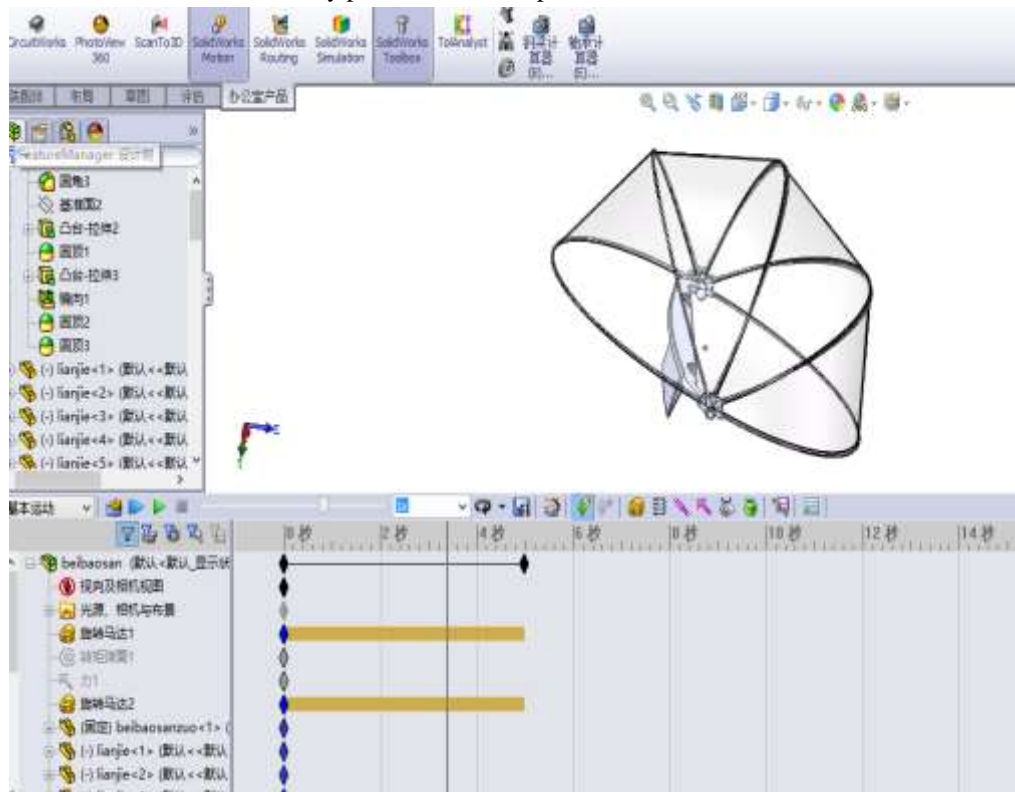



Figure 10 the motion simulation of remote boating umbrella

After the completion of installation, click the button to begin the calculation of the motion simulation. If the color of the time bar which is used to computing time is buff, it shows the calculation is successful. If the color is red, the calculation will be ended which proves that the model can't achieve the motion simulation. At this time, the design of computational process or the 3D model should be re-examined so as to modify the mistakes. Then the motion simulation is repeatedly until it achieves the fixed action. Figure 10 shows the motion simulation of opening the backpack umbrella.

IV. THE RENDER DESIGN OF THE PRODUCT

Photoview 360 is interactional software that can achieve real-time ray tracing and global light rendering. Since there are no need of complicated background and professional background knowledge, it is simple to learn and operate and is very suitable for render design in industry. Its interface can connect seamlessly with Solidworks, thus there is no need of re- allocation and update.

After umbrella modeling is achieved by using the Solidworks, click the interface button  of Photoview 360 in the tool bar of Solidworks. Then the model will be passed to Photoview 360, in which the material of the parts will be fixed. After that the model can be updated into Photoview 360.

After the material parameters are fixed, rendering can begin. Figure 12 shows the design method of rendering backpack umbrella. The generated effect drawing can be showed to customers and consumers. It can also be used to make package figure by combining with Solidworks Composer. What's more, it also helps for the marketing and the writing of product manuals.



Figure 11 the interface of Photoview 360 in Solidworks



Figure 12 the drawing of rendering backpack umbrella

V. THE GENERATION OF UMBRELLA SHOULDERING

Fasten feature is the main basis of industrial production such as the design idea, manufacture, debugging, usage and maintenance, etc. In general, Fasten feature is made up of view, dimension, technical requirement and the specification of the title bar, etc. Solidworks supports GB and can establish national standard of 2D drawing sheet. When Solidworks creates 2D fasten feature for parts and assembly, the feature of the fully association of it enables the 3D model to interconnect with the fasten feature so that any modification of parts or assembly will be promptly updated in the fasten feature, which will not only reduces repeat drawing, but also avoids unnecessary mistakes because of the disunity model drawing. Figure 13 is a 2D drawing generated from the umbrella shouldering. Solidworks also has the function of multifileoutput. By “saving as”

and intercalating, the file format of “dwg” and “dxf” which are compatible with Autodesk CAD can be output to provide conveniences for communication about engineering.

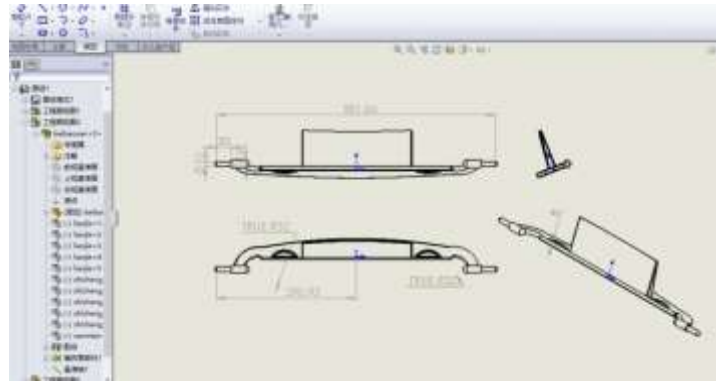


Figure 13 2D manufacturing drawing of shouldering

VI. THE REAL OBJECT OF CREATION OF BACKPACK UMBRELLA

According to the statistics in the drawing, select light aluminum product and firstly manufacture the umbrella frame , then fix the transparent and plastic umbrella fabric on the shouldering, finally, such a hands-free backpack umbrella is finished.

VII. CONCLUSIONS

Recently more and more people like late-model umbrella, but designing this kind of complicated backpack umbrella needs professional soft wares and advanced design method. As powerful 3D software under the Windows system, Solidworks is easy to learn and use. It adopts top-down design method to improve the speed of design, lower the error ratio as well as interposition checking and motion simulation, etc. Resourceful plug-in units and secondary development will extend the function of Solidworks to make it more powerful. Combining with the 3D rendering software of Key shot will be undoubtedly a good method to design umbrella. The function of relational 2D fasten feature will improve the speed of drawing and make less mistakes. The integrated application of these functions of Solidworks is of great importance to improve the overall level of product design of our country and shorten the distance between our country and the developed countries.

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