3D MODELING OF FURNITURE AFTER AN IMPORTED MODEL

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Abstract : The research presents various methods of 3D designing and modeling in SolidWorks using imported models, such as photos mostly. Should the design be made for unique furniture pieces, special orders or restoration works then the original model must be strictly followed. There are various methods of designing according to available shapes and models. The research develops the process of reconstruction of a church seat having as start point its image in a jpg. file. Most of the geometrical and dimensional elements can be reproduced at their scale, but the styling detail of the railing post has to be copied (reconstructed) entirely. The process of reconstruction will start gradually from a relevant image of the church seat in order to reach at its 3D model created in SolidWorks. After the reproduction of each element, all reference marks are gathered and put through the final checking process.
Keywords : 3D Modeling, SolidWorks, image import, reference plane, spline curves.

1. INTRODUCTION

The research presents various methods of 3D designing and modeling in SolidWorks using imported models, such as photos mostly.

Rarely used in furniture projects, 3D designing methods based on 3D surface operations or 2D profile management of revolution movement objects that are passed through by a symmetry axis which results in a rotation object - will be presented. Should the design be made for unique furniture pieces, special orders or refurbishment works then the original model must be strictly followed. The making of the railing post for the church seat will be presented step by step through 3D modeling in SolidWorks. An image of the railing post showing the profile to be shaped is prepared. Then the image is imported in a plane of the design, transparency is set for the image and is overlapped with a reference plane that has the railing post profile drawn in a spline curve from a distant plane. Then the profile is adjusted by setting the curves and the dimensions of the profile tangents. A vertical centerline is inserted necessary in the revolve operation and then the 2D sketch is closed. From 3D features the revolve operation is initiated, the parameters are set and then the 3D railing post is obtained. Color, texture and material for the object are set and saved. The rest of the assembling details are prepared together with the reference marks and then they are composed in order to obtain the 3D furniture object.

A modern way to create a 3D model of an object is to use a 3D scanner. This method could be used especially in important restoration works, due to the high costs for the equipment.

2. STUDY ON THE IMAGE IMPORT TO A 2D SKETCH IN SOLIDWORKS

The study presents the making of a railing post for a church seat by using 3D modeling in SolidWorks.

A sketch is opened in Front Plane. Isometric View option is chosen from the Standard View menu. By activating the Features option, you pick the Plane option from the Reference Geometry ([1], [2] and [6]). In the Properties menu that is opened a name for the plane should be entered – or you can leave the pre-set name "Plane 4". Then you pick the option that makes it Parallel Plane at Point and insert the 100 mm distance. In the Isometric View fig. 1 you can observe the plane position in relation to the Front Plane and Origin. Behind the origin point you can choose the reference plane position and correct it if the position is not right by validation of Reverse Direction button.
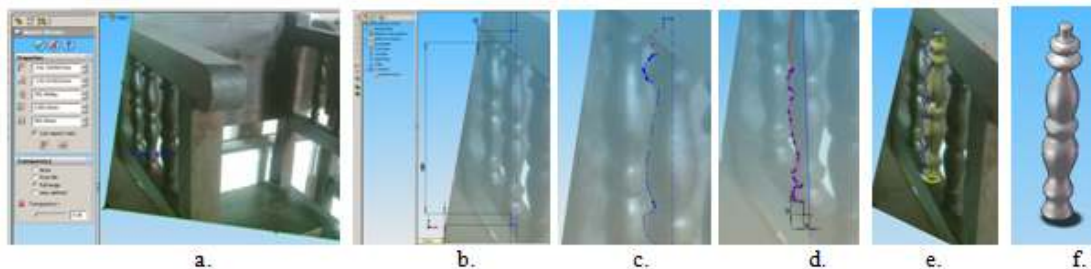
An image of the railing post showing the profile to be shaped is imported in the reference plan with Front View visualization. From the Tools menu, Sketch Tools, Sketch Picture you open windows, then choose the file type: Pictures (.bmp, .gif, .jpg, .jpeg, etc) and you activate the chosen image. You can always choose the Preview option in order to view it in the reference plane. From the Sketch Picture options you can translate the image on x,y reference axis, controlled by dx values and dy or even turn it upside-down in mirror view by using Ox and Oy axis.

Figure 1: Inserting the image in a reference plane,
a. Reference plane creation, **b**. image import in a plane, **c**. image positioning in a plane.

## 3. CREATION OF A 3D MODEL BASED ON IMAGE IMPORT

An image can be set with a multitude of transparency degrees so that a 2D sketch is created in a front plane overlapping the image. If a vertical centerline has been set in another reference plane for the railing post to have a precise dimension, in this case we can position and set the image correctly and the right dimensions. A new sketch is opened in the front plane or another relevant plane that is parallel and overlapping the image. Using a spline curve the railing post profile is drawn after the distant plane image.

Figure 2: Modeling a 3D railing post using an image
a.   Reference plane image; b. Transparent image with a scale; c. Making a spline curve on the profile;
d. Adjusting a spline curve; e. Profile rotation; f. 3D model of the railing post.

The profile is adjusted by setting the curves and dimensions of the tangents. A vertical centerline is positioned necessary for the revolve operation and the 2D sketch is closed. From the 3D Features the revolve operation is initiated, the parameters are entered and the 3D railing post design is obtained. Color, texture and material for the object are set and saved. The rest of the assembling details are prepared together with the reference marks and then they are composed in order to obtain the 3D furniture object.
Another method uses horizontal and vertical lines in order to create control points for the spline curve. The image in the distant plane is enlarged, then the option of setting only ortho (horizontals and verticals) lines is set and then a vertical line is drawn through the axis of the railing post and few more horizontal lines from the axis to the modulation points or any other points from the profile. Additional lines can be used in order to control the geometry of the model. After the outline of the railing post is created, by using the Trim button the additional lines can be erased. Then the revolution object is obtained with revolve. Considering the symmetry of the railing post only half of it is created; the other half being easier to generate with the Mirror option in vertical plane. Color, texture and material are completed and the reference mark is modeled.
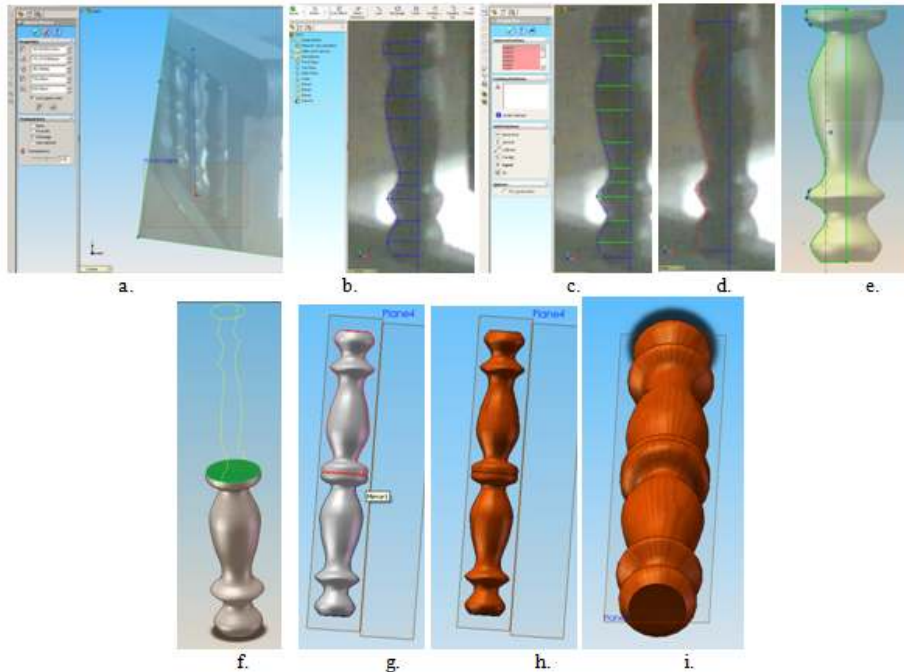
Figure 3: 3D Modeling by using symmetry; a. inserting the axis in the image; b. additional lines setting; c. lines' preparation; d. curve adjustment; e. revolution movement object creation; f. symmetry selection plan; g. final baluster; h. texture and material apply; i. final view

4. ASSEMBLY, RECONSTRUCTION AND VERIFICATION

To assemble the pews, the rest of the parts are made [4]. The parts will be modelled in the base standard plans, depending on their spatial position on the ensemble, like in picture 4.
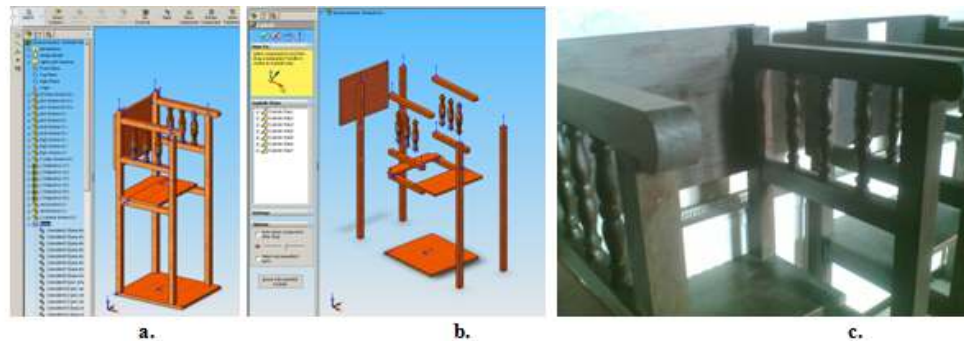
Figure 4: The pew; a. isometric view of the 3D model; b. exploded view; c. initial view of the pew.

For the models presented, it is considered that the original baluster was well reconstituted through the models presented.
At anytime, it be intervened on the model drafts and improve the profile or modify the certain dimensions.
Checkups can be made by comparing the initial model with the resulting 3D model, and the differences can be remedied by modifying the operation sketch that generated the error and the reconstitute the modified model over the existing model or create a new modified version of the pew.
A modern method could realise the 3D modelling of the parts by 3D scanning [5]. It is not a reconstitution of the object image but of the real object, or of a reduced scale prototype.
After scanning, the cover surface of the object is generated, and the object can be reconstituted 3D. The method can be used in furniture, mainly for major restoration projects, because of the equipment high costs.

5. CONCLUSION

The study presents the method to reconstitute an object based on an image, following each step of SolidWorks, from the initial phase of drawing sketch through the final 3D model.

This study was done for the baluster, a model that needs defined the generator, the axis and to calculate the revolution body. The method can be applied even when other 3D operations are applied (extruded boss/base, extruded cut, revolved boss/base, swept, lofted, etc.).

REFERENCES

[1] Bîrlogeanu, C.: SolidWorks soluţia 3D completă, Review NET_REPORT apr-mai 2005. Bucuresti.

[2] Comşa, Gh., N.: Designing the wood finished products using the 3D modeling with Solid Works, Proceedings 6th edition international conference "Wood science and engineering in the third millennium, June 20-22 2007, "TRANSILVANIA" University, Brasov, ROMANIA, p. 467 - 471 , Brasov, Romania, 2007.

[3] Comşa, Gh., N.: The parameterized designing of a bookshelf by means of SolidWorks, 12th International Conference – TMCR – IASI-ROMANIA, May, 2008, BULETIN POLYTECHNIC INSTITUTE OF IASI, TOM LIV, Fasc.1,p. 423 – 428.

[4] Comşa, Gh., N.: The creation of the multifunctional modular furniture by means of SolidWorks, 12th International Conference – TMCR – IASI-ROMANIA, May, 2008, BULETIN POLYTECHNIC INSTITUTE OF IASI, TOM LIV, Fasc.1,p. 429 – 434.

[5] Udroiu, R., Comşa G., N., The Role of Rapid Prototyping in Furniture Industry, The Study of curved Chair employng COSMOS Xpress Finite Element Method, Proceedings 7th edition international conference "Wood science and engineering in the third millennium, "TRANSILVANIA" University, Brasov, ROMANIA, p. 696 – 701, Brasov, Romania, 2009.

[6] www.solidworks.com