Development of the 3D Engraving System from 2D Images

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abstract

Design is important in the IT, digital appliance, and auto industries. Aesthetic images are being applied for making better design. Various images are used to improve design quality. However, it takes much lead-time and effort to implement them for 3D engraving processes. In this paper, a hybrid reverse engineering method generating accurate 3D CAD models from 2D art images is proposed through the image processing, 3D reconstruction, B-spline surface interpolation and fairing methods. Cloud points with z-depth are extracted according to intensity values of the image. Adaptive median and harmonic filters are used to obtain accurate intensity values. B-spline surfaces are generated through the interpolation of cloud points and the optimization of the fairness. Performance of the developed turnaround system is verified through construction of 3D CAD models, generation of tool-paths and high-speed machining of molds.

terms

3D Engraving, Fourier Transform, IGES, Image Processing, B-spline Fitting, Optimal Fairing, TechArt Technology
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Design is important in the IT, digital appliance, and auto industries. Aesthetic images are being applied for making better design. Various images are used to improve design quality. However, it takes much lead-time and effort to implement them for 3D engraving processes. In this paper, a hybrid reverse engineering method generating accurate 3D CAD models from 2D art images is proposed through the image processing, 3D reconstruction, B-spline surface interpolation and fairing methods. Cloud points with z-depth are extracted according to intensity values of the image. Adaptive median and harmonic filters are used to obtain accurate intensity values. B-spline surfaces are generated through the interpolation of cloud points and the optimization of the fairness. Performance of the developed turnaround system is verified through construction of 3D CAD models, generation of tool-paths and high-speed machining of molds.

INTRODUCTION
Recently, aesthetic design is important for upgrading quality of products and manufacturing high value-added goods. This generates TechArt technology in the IT, digital appliance, and auto industries. TechArt means a design technology to transform engineering items to products with aesthetic design features. Using the aesthetic design patterns, design quality of commercial products is significantly upgraded. Valuation of IT, digital appliance and auto products is improved as well.

Various aesthetic and artistic images have been used to satisfy the design demand. To realize a 3D art shape on products, 3D TechArt CAD model is required for 3D engraving. Contrary to generate simple 3D art patterns, generation of complex 3D aesthetic CAD models is difficult and time-consuming. To reduce the lead-time and to realize the TechArt technology, an artistic 3D engraving system generating 3D art CAD models from 2D art images is required. In addition, to maximize the interfacing flexibility with commercial CAD/CAM systems, neutral CAD files for visualization and healing are also required.

In previous studies, the shape from silhouette (Cheung et al. 2005) used 2D images for 3D reconstruction. But it requires many images and...