

The Innovation Design of Product Based on Reverse Engineering

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Abstract. The concept of reverse engineering, reverse design process and reverse analysis were introduced in this paper, which has been used in teaching practice of mechanical design specialized curriculum, the students will be guided to apply method of reverse design to the innovation design of product by motorcycle as an example. Through the reverse design and analysis of motorcycle, students have a comprehensive understanding about computer integrated manufacturing system, which will cultivate technology talents who can adapt to the advanced manufacturing technology development and meet the requirement of the society.

Keywords: reverse engineering, reverse design, innovation design

1. Introduction

With the development of science and technology and the market competition, products are heading for the direction of many varieties and small batch, the higher request on enterprise's product development were put forward. "Reverse Engineering"(RE), as the important supporting technology which digest and absorb advanced technology and shortened the cycle of product design development, has become the focus in manufacturing. With advanced products or technologies as an object, analyzing and researching deeply, mastering key technology reverse design is innovation design in similar product on the basis of digesting and absorbing.

2. Overview of Reverse Engineering

Reverse engineering, also called reverse engineering, is measured by means of some kind, or model data acquisition, reconstruct the general three-dimensional model by computer according to measurements. It implements the geometry model from the physical to the direct conversion, which is advanced manufacturing technology of fast developing and manufacturing high value-added products, with characteristics of product design and manufacturing significantly shortening the cycle. From the engineering point of view, the object may include the kind of reverse, reverse imaging software such as anti sum of three categories. At present, based on the real of reverse engineering in the modern advanced manufacturing technology in the proportion is getting old.

2.1 Physical reverse

Physical Reverse is the entire process of new products re-created, which is in the real physical conditions, through testing, mapping and detailed analysis, Including functionality, performance, program, structure, materials, precision, and many other aspects of use of standardized reverse. Usually, physical reverse objects is mostly the more advanced equipment, products, including the introduction of advanced equipment from abroad, products and domestic products. Reverse Engineering based on physical, using 3D digital measuring instrument accurately, rapidly to access point cloud image, and then through the surface to build, edit, and modify, create a CAD three-dimensional model, the placement in general CAD / CAM system, then NC processing path is calculated by the CAD / CAM, finally the actual product is processed through CNC machining equipment. Reverse Engineering based on physical is actually re-design process by using CAD /

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CAM / CAE technology from the model to the CAD model and then the actual product, which is one of computer integrated manufacturing (CIMS) technology. Physical reverse characteristics: testing and analyzing the product performance, functionality, materials directly to obtain detailed technical information products; testing on the size of the components of products directly to obtain the product dimensions; starting point, to shorter product development cycle. For developing countries, reverse engineering is one of important ways to obtain the core technology or know-how. In order to ensure the leading position in technology, the developed countries always try to protect its technological secrets, the high cost of direct introduction of technology and hard to get the core technology. Through the reverse analysis, you can master the advanced technology in the digestion and be innovative, able to quickly catch up with even more advanced technology than its competitors.

2.2 Image reverse

According to photographs, images, video images and other image data acquired by reverse engineering products, the amount of information is very small, difficult to reverse, requiring designers to have more extensive experience in design practice. First of all, according to the image data can get some design ideas, and guide the designer to creative design; Secondly, based on analysis of product requirements for the work program of its functions and principles; Third, the structure of products and materials, the basis of known information, refer to the function and working principle of reasoning.

2.3 Software reverse

Software refers to drawings, technical information documents, product samples, brochures, etc. Software reverse will know product function, principle and structure of the program, if there are part drawings, more about the part material, size, accuracy can also be learned.

3. Reverse Design

3.1 Reverse design process

Reverse design is divided into two stages against summation redesign. Reverse phase mainly through the analysis of existing products or technologies, learn key technologies to achieve for our own use; the original product or technology to verify the existence and problems of conflict, innovative design for the improvement or a clear direction. Re-design phase, also known as the second design phase, mainly copying the same type or the development of innovative products. Reverse design process shown in Fig. 1.

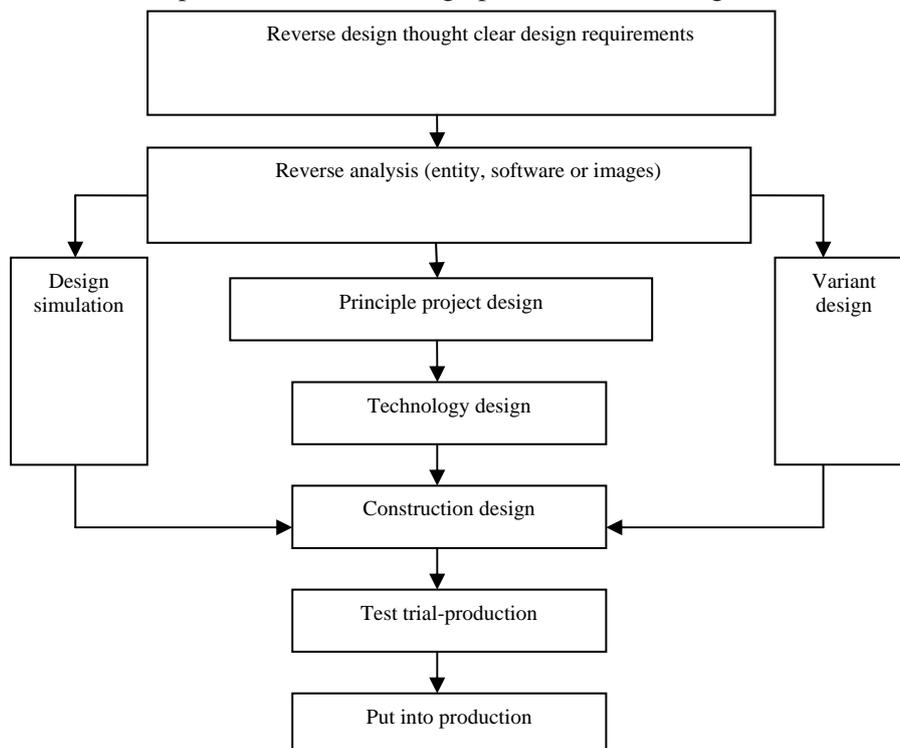


Fig. 1. Reverse design process

3.2 Reverse analysis

In the teaching of mechanical design, mechanical and electrical products - motorcycles, for example an anti-seeking analysis:

- Reverse design thought

Understanding the guiding principles of product design is an important prerequisite for product design, and is the key to explicitly reverse design requirements. Some products to extend function, reduce cost and improve market competitiveness; Portable, flexible pursuit of another goal of some products; Sustainable development, energy conservation, environmental protection, green design, humanity is the embodiment of modern design. Seizing the product design to identify the root of the original design is conducive for key technologies. The own innovative design ideas will be established on this basis. Motorcycle function is to carrying people, loading, driving. In the existing domestic motorcycle market analysis, understand the market share of the highest import motorcycle function.

- Principle scheme analysis

Products are for functional requirements for design, the realization of the function of dependent on principle project guarantee. Exploring the original design of the working principle, structure characteristics, and further research for the same principle solution is to realize the function of new technology innovation reverse design of the important step. Motorcycle consist of a power source, transmission, execution systems, control systems, detection systems and other components, The power source can be a current of electricity, it can be others such as solar energy, heat, etc.; Mechanical drive transmission system can also be a power transmission, etc. As shown in Fig.2.

- Structural Analysis

Components Is a function of vector. Structure in different ways, so that measures ensured for functions is different, then the product characteristics are also different. Meeting the same physical action, there is different transmission structure, Such as gear transmission, hydraulic transmission, etc. A structural analysis and take account to improve performance and reduce the cost, improve safety reliability whether have reform and innovation of space. As shown in Fig.2.

- Material analysis

The same parts, using different material and material handling way, to the function of the part, processing, have an important impact on performance. Explore the original design parts material of chemical composition and structure and surface treatment condition, can use a surface observation, chemical analysis, metallographic examination methods. Determination of the physical properties of the material and the main mechanical performance, can ensure materials brand and heat treatment way, thus on your product design consider to choose the applicable homebred material substitution.

- Form dimension analysis

If the original entity or drawings of circumstances can be obtained, measured and analysis directly will be done, and expression in drawing. For original image, through perspective size, can press the proportion between the referents reverse the original size. Presently available computer aided technology, automatic measurement, reconstructed CAD model, automatic forming, NC machining combine, used for three-dimensional molding design and the reverse.

- Process and precision analysis

It is very important to analyze product machining process and key technology, Based on the choice of reasonable craft parameter, confirming that the new design products manufacturing process. Component surface shape, size, element relative position requirement is to guarantee the basic condition of parts function.

- Working performance analysis

The main performance of products such as the strength, stiffness, precision, life and safety test determination, grasp their design requirements and design standard.

- Appearance modeling analysis

Product appearance modeling is the product of visual language, most can individuality of products, in competition of the commodity plays an important role. Modeling design and analysis of the basic principle is practical, economic, beautiful and humanization, however, it must ensure function requirement.

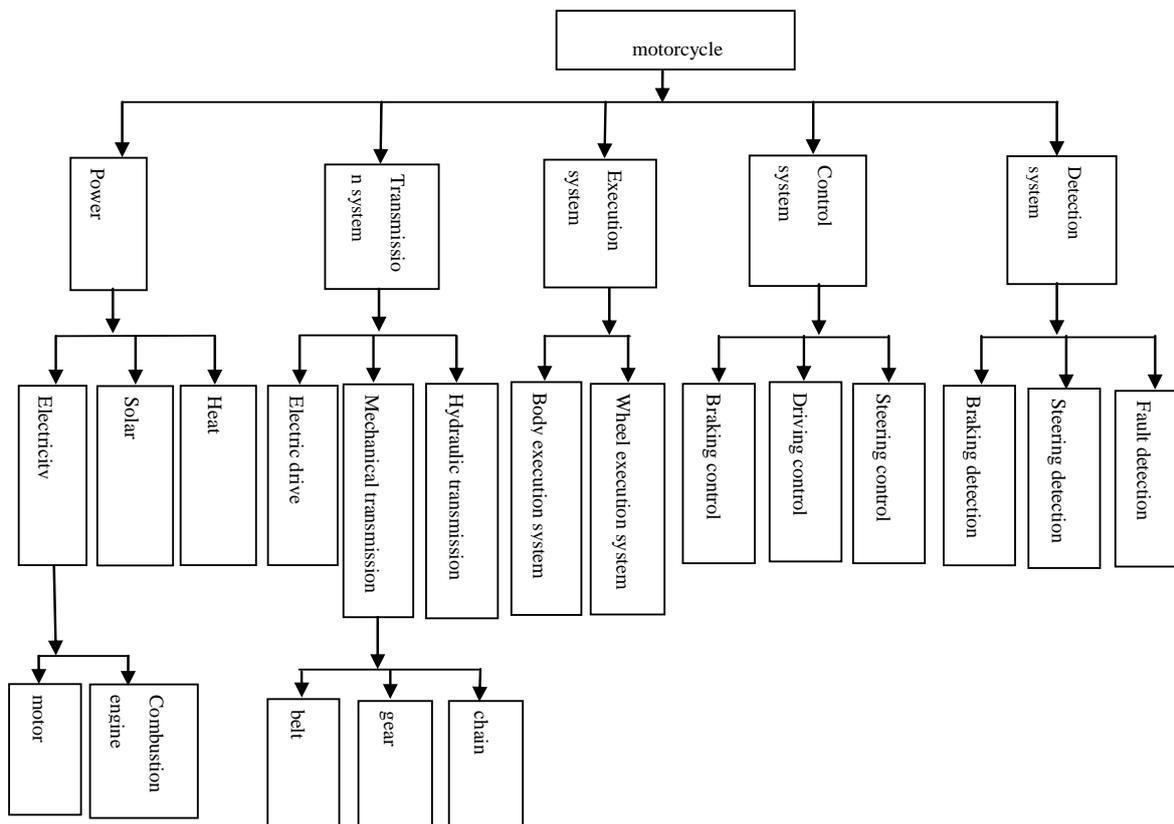


Fig. 2. Motorcycle reverse analysis process

- Others

Include using, maintenance and packaging technology, etc. Advanced product should have good performance characteristics and maintenance performance. Packaging is commodity visual languages, can convey the product's personality. Packing strategy is an important part of the product marketing.

4. Conclusion

Mechanical and electronic products in the competitive market, under the situation of introduction, digestion and absorption of advanced foreign product design concept, method is to enhance the competitiveness of products of a powerful way, and through reverse design, easier to get innovative products. In modern design talents cultivation of university teaching, should pay more attention to the modern design ideas and design theory teaching and the actual production of contact, will reverse design used in the practical design of motorcycle, guiding students to import high-grade motorcycle on reverse analysis, proposed many design scheme, again, it is concluded that the optimal plan to manufacturers satisfactory solutions, classroom teaching and production practice combined and achieved good effect.

5. References

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