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Enhancing Mechanical Design Quality through Optimization Strategies and Automation Technology

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Abstract: The advancement of contemporary industry has led to the widespread adoption of diverse mechanized production equipment, which has become the primary driving force behind various industrial sectors. This transition has significantly contributed to the advancement of these industries. Enhancing mechanical design has emerged as a crucial foundation for improving its quality and practicality. Consequently, it is imperative to employ a range of modern technologies to achieve efficient optimization of mechanical design.

Keywords: Mechanical design; optimization measures; automation technology.

1. Introduction

Design as the basis for the realization of various types of mechanical products, design quality has a significant impact on its basic performance, functionality and quality, especially for the current situation where various types of mechanical products have been widely used in various production industries, and actively promote mechanical design The importance of quality is becoming increasingly prominent. Therefore, how to actively optimize the mechanical design quality with the support of existing technical means has become the main research goal of the current industry.

2. Mechanical Design Optimization Ideas

At present, the optimization of mechanical design needs to be mainly considered from the three aspects of whether the mechanical design plan has standardization, serial production and large- scale generalized production. The realization of the above three design ideas can further realize the design of mechanical equipment The large-scale short-term production of the company, and on the basis of improving the interchangeability of equipment functions, enable enterprises to effectively occupy market share in a short period of time and achieve profitability. Among them, standardization of production refers to that in the production of the designed machinery, only according to the information of the product installation manual, after selecting the corresponding parts, the assembly can be completed, put into use, and the subsequent maintenance components are reduced; serial production means that the mechanical design scheme needs to be flexible , That is, after discovering the technical problems of the previous generation of mechanical products, it can be optimized and upgraded by replacing a small number of core technologies and components in the general design framework, which has a positive significance for the design of professional product lines of production enterprises; large-scale general production Means that in the mechanical product design scheme, except for the production technology of individual core parts with higher technical core, the basic assembly production technology adopts the general scheme and parts to complete the assembly, which enables the enterprise to complete the production line update in a short time and enter Mass production mode, and can effectively control production costs while improving production efficiency [1].

3. Mechanical Design Optimization Principles

The current mechanical design optimization schemes are mainly divided into two categories: new technology R & D and transformation optimization. The former is based on design and production technology innovation, and is based on industry needs to develop new mechanical equipment. The latter is based on the original design scheme. Innovation and optimization of key technologies to effectively improve the performance of mechanical equipment. But the above two types of design schemes need to follow the following design optimization principles to complete the design.

3.1. Performance Principles

The performance principle mainly refers to the functional and operational stability of mechanical products. In terms of product functionality, the production samples must fully realize their original design intentions before the product is put into actual production; in terms of equipment operation stability, it is necessary to ensure that the production samples can meet the actual The production meets the demand, and after the failure, it can be maintained in a short period of time through general-purpose parts and repair technology, and continue to be put into production.

3.2. Feasibility Principle

The feasibility principle includes two aspects: production cost feasibility and technical feasibility. Cost feasibility means that after completing the mechanical design, it can be put into production by improving and optimizing some of the core production technologies on the basis of the original production technology of the enterprise or directly applying the existing technology, and has the advantage of lower maintenance costs in practical applications. It is convenient for the large-scale application of the produced machinery and equipment; the technical feasibility is mainly concentrated in the production technology and maintenance technology, the specific performance is the same as above, so the production cost and technical feasibility are complementary.

3.3. Security Feasibility

The safety feasibility means that the designed mechanical products need to reduce the complexity of production and application operations as much as possible in practical applications, and reduce the safety risks in manual operations. It is also necessary to take the best safety protection measures for various parts of mechanical equipment and reasonably avoid various types of mechanical equipment Security risks.

3.4. Environmental Feasibility

Affected by the particularity of the production materials of mechanical equipment, metal materials are widely used, but in order to realize the aesthetic value of the appearance of mechanical equipment, decorative measures are often used to improve the appearance of the equipment, and such circumstances may increase the equipment environment after special technical treatment. Hazard, it is necessary to adjust the appearance treatment technology from the perspective of environmental protection in the appearance treatment of mechanical equipment to improve the environmental performance of products [2].

4. Overview of Mechanical Design Optimization Procedures

4.1. Design Preparation

The degree of design readiness is the starting point for the design optimization of mechanical products. In this stage, enterprises can plan the basic conditions of equipment functions, performance, costs, etc. through the market demand for mechanical products, and then through the relevant equipment design, production and technical type information The collection and analysis of the product will be improved on the basis of planning to ensure that a mechanical design plan with actual production feasibility is given.

4.2. Design Adjustment

The design adjustment is the secondary adjustment of the design plan after the enterprise completes the basic mechanical design plan, through the multi-party collection of market consumption demand and equipment production core technology and other relevant information. In the secondary adjustment stage, it is necessary to focus on the designed mechanical equipment The production core technology, production cost and enterprise benefits shall be considered in many aspects to determine the actual production plan.

4.3. Technical Adjustment

After confirming the actual production plan, it is necessary to start from the principles of design optimization feasibility and safety, and combine the actual production technology of the enterprise to adjust the production technology of core components to ensure that the technology is approaching the direction of generalization. On the other hand, it is necessary to adjust on the basis of the types of existing production parts, and on the basis of effectively realizing the performance and functionality of mechanical equipment, select general parts and technologies for assembly.

4.4. Prototype Adjustment

After determining the design plan, production technology and parts, the prototype production needs to be carried out first, and the comprehensive evaluation of the prototype function, performance, design and production benefits, etc., and then adjust the design problems in the prototype. , After perfecting the design, formulate the final design plan.

4.5. Actual Production

Before the designed mechanical equipment is put into production, the full set of design drawings and technical documents of the adjusted prototype shall be submitted for review according to the prototype adjustment and final design plan. After the review is passed, it will enter the mass production stage, and the product feedback will be required after the product enters the market. Information is periodically investigated, and product problems are adjusted based on actual use problems and product feedback, etc., and serial production adjustments are made [3].

5. Overview of Design Optimization Schemes

At present, the main optimization schemes for mechanical product design are divided into three types of optimization schemes: constrained, unconstrained and fuzzy. Among them, the main purpose of the constrained optimization program is to analyze the design problems at various stages with the help of iterative changes in the mechanical product design process, and then complete the optimization based on various constrained new production conditions; the main purpose of the unconstrained optimization program is to use various model statistics The method realizes the organic adjustment of the relevant content; the main purpose of the fuzzy optimization scheme is to use the mathematical model of fuzzy transformation to realize the formulation and adjustment of the optimized content of various problems.

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