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WEB-Based Computer Aided Innovation Design

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Abstract: *The development of science and technology, the gradual promotion of various new technology tools in various fields, and mechanical design also actively encourage the continuous application of various new technologies. The design provides higher comfort, greatly reduces product design time, and creates higher economic benefits for the enterprise. The application of computer-aided design in mechanical design is briefly discussed. The scheme design of the mechanical system directly determines the function, quality and cost of the product and is the key to product design. At present, the research and application of computer-aided design technology in the design information expression, structural performance analysis and product data management of general mechanical systems are becoming more mature, but the support for scheme design is still relatively weak. Given that computer-aided solution design of mechanical systems often relies on expertise in specific fields, and may require the use of dedicated design models and specific intelligent design methods based on the characteristics of the design problem, most of its research and development work is aimed at specific areas and used for special purpose systems for mechanical systems. Two principles of innovative design ideas are summarized: the shortest path principle and the similarity principle, the current research flaws based on modern proof technology are analyzed, and a combination of genetic algorithms is proposed to solve it. A quantitative method of physical similarity was proposed, and the similarity was used as the basis to combine genetic algorithm with computer-aided and initial population selection to create an improved genetic algorithm. In this paper, a computer-aided innovation design system based on WEB is studied. This article takes automobile cover molds as an object. When the mechanical system workload is 20J, the traditional method consumes 60,000 yuan, and this article consumes 13,000 yuan. When the mechanical system workload is 60J, the traditional time consumed by this method is 50min, and the time consumed by this method is 15min. The working efficiency of the traditional method is 70%, and the working efficiency of this method is 93%.*

Keywords: *Mechanical Design, Creative Design, Computer Aided, Creative Thinking*

1. Introduction

The topic of robot computer-aided design has always attracted people's attention. In 1986, he published a monograph on "computer-aided design, selection, and evaluation of robots." He indexed the motion range and speed of the four joints that might make up a robot, and A total of 89 parameters, such as actuator, joint drive unit, joint control unit, and design parameters, were specified qualitatively or quantitatively (16 divisions). A program flow was also given on how to determine the relevant code according to the design requirements, which is a robot computer Assisted design created a precedent. While developing a modular robot, the general principles of selecting modules were also given. The former research mainly focused on how general robots determine the code based on design parameters, so as to determine the topology and structural parameters of the robot that meet the design requirements. It has certain guiding significance when designing new-type robots. The high-efficiency, precision, and low application costs of special-purpose robots have been fully reflected in large-scale industrial production, but in the face of future changes and small-scale flexible production requirements, special-purpose robots Design cycles and manufacturing costs have become urgent problems to be solved. The introduction of the modular concept into the robot design has injected new vitality into the flexible processing system. Selecting the appropriate modular robot topology and standard modules, and quickly forming a modular robot is an effective way to shorten the robot design cycle and reduce the production cost. The modular robot will Become one of the most important equipment in the future flexible processing system. The tasks performed by the robot determine the functions and performance requirements of the robot. It should be emphasized here that the topological relationship of the robot

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determines the function of the robot, and the joint characteristics and the length and quality of the link will affect the performance of the robot. In other words, When the robot's topology relationship is determined, the robot's functions have been determined, and different joint and link parameters will only affect the robot's performance. This assumption makes the two-way mapping between the task-function-structure of the modular robot into may.

With the development of computer technology and the development of artificial intelligence technology, mechanical innovation design methods have gradually shifted to intelligent computer-aided mechanical innovation design development based on traditional empirical innovation design methods; the combination of evolutionary design methods and mechanical innovation design, A new research direction of mechanical innovative design has also emerged-innovative design of mechanical evolution [1-2]. Mechanism is the backbone of mechanical products, mechanical engineering is the foundation of mechanical products, mechanics is one of the most important theoretical disciplines on which scientific mechanical design is based, and its main task is to design good performance (including innovation, invention and important innovation, etc.) [3-4]. Therefore, mechanism is an important research content for the conceptual design of science and mechanical products. Its basic content can be divided into three major components: mechanism structure, mechanism kinematics, and mechanism dynamics [5-6]. The main themes of the institute research can be divided into two categories: institutional analysis and institutional synthesis [7]. The mechanism analysis mainly studies the structure, kinematics and dynamic characteristics of the mechanism, and reveals the structure, mechanism and dynamics of the mechanism and their interactions. It is used to analyze and improve the existing mechanical system, and more importantly, it is used for the comprehensive theory of the mechanism. [8]. Institutional synthesis mainly studies the innovative concepts of new institutions, theories and methods of invention and innovative design [9]. In fact, the new organization refers to a new structure or scale with better performance. The invention patent of the new organization mainly relates to the original design of the structure [10]. Institutional synthesis includes three aspects, namely type synthesis, number synthesis, and scale synthesis.Type synthesis is the process of selecting the appropriate institution type from all possible institution types; number synthesis is based on the selected institution type and number of degrees of freedom. Determine the number of components and kinematic pairs; scale synthesis is to determine the structural parameters of the mechanism such as the length or angle of each component that affect the mechanism's kinematic performance (displacement, speed, acceleration) [11]. Institutional synthesis is the basis for implementing innovative design of institutions, and is an important content of the conceptual design of mechanical products [12]. Function generation mechanism synthesis and guidance mechanism synthesis are two basic types of comprehensive research on mechanism motion.Generally speaking, guidance mechanisms can be divided into two types. One type is a mechanism where a point on a rigid body moves according to a given trajectory or a given point. The point guiding mechanism or the mechanism to achieve the expected trajectory, the other is a mechanism through which rigid bodies pass certain positions, called rigid body guiding mechanism [13]. The guiding mechanism is generally implemented by a link mechanism and its combination with other mechanisms.The shape of the guiding trajectory is related to the size and position of the generating mechanism, and the size of the mechanism can be varied, and the position of the generating trajectory point can also be Infinite, which makes it difficult to study the change law of the trajectory. So far, people have only studied the change law of the guide trajectory (link curve) of the planar four-link mechanism on the link plane. The problem of the scale synthesis of the mechanism that produces the guided trajectory is also one of the difficult points of the mechanism study [14]. The mechanism trajectory generation theory specializes in how to generate the expected trajectory. Its research focus is on the point-guided mechanism generation method, the purpose of which is to obtain a mechanism that can achieve the expected trajectory at a certain point on the component through the mechanism synthesis. Based on the mechanism trajectory generation theory, it is possible to generate a variety of mechanisms that achieve the expected trajectory for type synthesis, and also to generate similar mechanisms of different sizes for scale synthesis. Therefore, the theory of mechanism trajectory generation is of great significance both in academic research and practical engineering [15]. After years of research by institutional scholars, although some research results have been achieved, research on mechanism innovation design methods based on motion trajectory generation theory is rare. To achieve computer-aided mechanism innovation design and product innovation design based on trajectory generation theory, There are many things that need further study. This article will study the theory of trajectory generation of guidance mechanism based on previous studies [16]. The Advanced Technology Department of the IBM Development Lab is developing a COMMEND (Computer Aided Mechanical Engineering Design) system. This design system is for internal use only and is currently unavailable to others or companies. The COMMEND system is a problem-oriented system, not a system for customization. Design or product-oriented design. It is equally effective whether it is designing a punch card, printer, file transfer or any such machine. COMMEND's main goal is to enable our mechanical design engineers to enhance their capabilities with high-speed computing and the large storage capacity of today's digital computers. It is not natural to combine engineers and computers into an effective design team. Both engineers and traditional computer operating modes must change. Engineers must adopt more analytical design methods instead of the graphical and experimental methods currently used on certain design problems [17].

Rakov sees the application of advanced morphological methods as computer-aided innovation (CAI) support systems for selecting and evaluating new technology solutions. The main goal of this method is to expand the range of latent variables, and to cluster and effectively select the comprehensive decision space to improve the feasibility of innovative solutions in the design phase. The proposed technique relies on cluster analysis, set theory, and a set of rules to maximize the potential level of developed techniques. Several examples show the application of this method. The technical solutions, manufacturing processes and control systems of micro-arc oxidation plants and PU foam grinding processes were considered and analyzed, and selected [18]. Gonen believes that in many applications, people involved in the assembly process must work in non-ergonomic positions. Incorrect locations can cause strain and persistence problems. In addition, the physical tension of workers can negatively affect labor productivity. Ergonomics should be used to avoid this negative impact on worker health and productivity. Ergonomics introduces the basic principles of the relationship between system productivity and the ergonomic environment. With a series of computer-assisted ergonomic analysis (CAEA), the necessary precautions can be taken in advance by identifying bad positions. With CAEA, mechanical productivity and people's comfort can be ensured by creating an efficient work environment without causing health problems for production workers. In this study, in an agricultural equipment manufacturing company, the current working position of workers performing tasks during the assembly of a wheeled hay harrow has been evaluated by the CATIA ergonomic analysis module [19]. Fu believes that the traditional way of developing agricultural machinery parts is to verify the feasibility of agricultural machinery parts through the manufacture of prototype machines. However, due to the shortcomings of long development cycle, large workload and easy operation, it cannot meet the needs of agricultural production. ineffective. Therefore, it is necessary to design and implement a digital design platform that combines mechanical analysis and computer simulation technology, and this platform can be used to test the design effects of agricultural machinery parts instead of manufacturing prototype machines. Therefore, by integrating computer-aided design CAD with self-developed analysis software based on the DEM-CFD-MBK coupling, a digital design software platform for agricultural machinery parts is designed and implemented, namely AgriD EM (Agricultural Discrete Element Method) . Discrete Element Method, Computational Fluid Dynamics, Multibody Kinematics). AgriD EM has 4 modules, namely boundary modeling and particle modeling [20].

The innovation method of this paper: Because the early mechanical innovation design method comes from the summary of the designer's experience, and the design use effect is highly dependent on the designer's experience and creativity, so the early mechanical innovation design method becomes the empirical innovative design method. (1) It is relatively easy to understand and has strong operability, but it is not easy to design innovative products.(2) It is not easy to establish an automation model, and it has poor computability, and cannot use a computer to assist the entire innovative design process, so the degree of automation is not high and the design efficiency is low.(3) The use effect is highly dependent on the designer's experience and creativity, and the scope of application is not wide enough.

2. Proposed Method

2.1. Computer-aided Innovation Design Method

Two innovative design thinking principles are fully embedded in the design of the computer-aided design system. The system also uses various innovative design technologies and artificial intelligence technologies. Figure 1 shows the flow of a computer-aided innovation design system. The following basic techniques are provided here[21].

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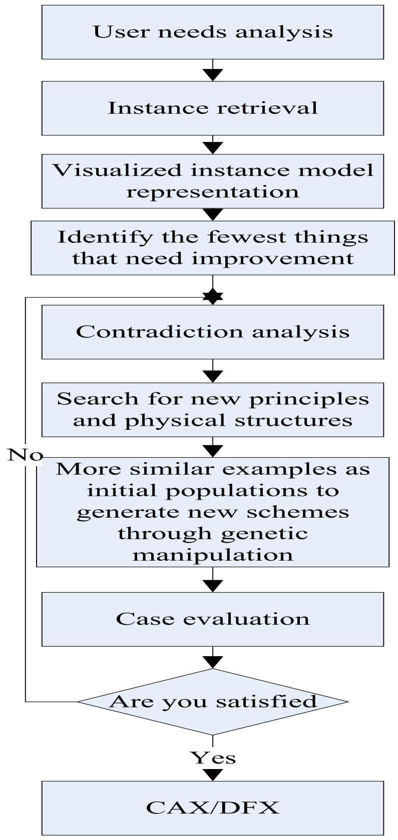

Figure 1: Product development process for computer-aided innovation

(1) Example retrieval

When using case-based technology (CBR), we must first explore its advantages and disadvantages. Databases that cause management difficulties and system inefficiencies. Second, only one or very few samples are obtained through searching. Other cases that do not meet the search requirements but contain application knowledge are not used. Cases that support innovation are not so powerful. Finally, domain knowledge is difficult to rely on sample adjustments, which is why many cbr systems are simplified to sample search engines. Similarity association finds similar patterns and uses genetic algorithms to optimize aggregation to achieve reuse of sample knowledge. Visual representation and management depend on the tree function of the belief product structure.

(2) Visual case model expression and method

The development direction of conceptual design technology is to learn how to express a design scheme. The literature expands the fbs diagram, and uses two frameworks to describe the functional level and structure of the design scheme and maintain functional units. The relationship with the structural unit enables the computer to understand the structure and function of the product. The disadvantage of this method is that the relationship between structure and function is insufficient, so the system provides functional links based on the functional hierarchy diagram and the structural hierarchy diagram. It is used to describe the semantic network structure and the functional connections between them so that the design and function are the same. Designers can intuitively understand the principle of the product, analyze the differences in the functional diagram, and use value engineering methods. Correct analysis of product inconsistencies. The main contradiction in product design is that the ratio of product cost to product is insufficient to meet user needs, and there are two forms of expression. The second is some features. The quality is improving, but the quality of some functions is decreasing. The results of conflict analysis are used to guide new "finding principles", new combinations of physical structures, and similar examples.

(3) Web-based innovative design knowledge base

The system's innovative design knowledge base includes a library of principles, a library of physical structures, and a library of samples. Extract the payment results, and then sort out more than 240 types of working principles (including more than 50 basic dimensions) for the mechanical field.

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Each physical principle has many physical structures, thereby creating a library of physical structures. The innovative design knowledge base is an integral part of the innovative design system. It is a web text database whose text is processed by the author's mechanical knowledge xml tag to create a knowledge base in international standard xml text. Therefore, knowledge resources can be shared in different locations, and a knowledge-based Web-based computer innovative design system can be established to meet the general design needs of different locations.

(4) Similarity quantification method and improved genetic algorithm

Each product has a different structure and requires a different genetic algorithm code. To maximize operational efficiency, the system accepts encoded floating point numbers. In traditional genetic algorithms, the initial population is formed in a random manner, which is a bit blind. Therefore, the authors suggest using the principle of sample movement or the similarity of physical structure as the basis for forming the original population. The key to the realization of this method is the quantification of the similarity, that is, the method of calculating the similarity. The essence of similarity is the relevant knowledge of the samples, which must be mined in a facility constructed by a specific algorithm. The similarity of vertical association is essentially the degree of correlation between functional goals and implementation methods, while the similarity of horizontal uniformity is essentially another degree of interaction between implementation methods. Higher similarity means more support for existing product samples. Based on similarity, the main population selection is similar to using previous design experience, because the initial population generation has a reasonable basis, which accelerates the convergence of the genetic algorithm. Based on the similarity principle, the following similarity calculation methods are proposed for vertical and horizontal combinations[22].

2.2. "Function-Behavior-Action-Structure" Process Model

For a long time, many experts have devoted themselves to researching design theories and methods for designing mechanical motion schemes based on functions. Once this problem is solved, a shortcut for mechanical motion scheme design can be found, which will also be beneficial to computer-aided schemes for mechanical products design. Researchers have proposed a "function-structure" model of function-to-structure mapping (referred to as F-s model). This model is refined in the analog-based design, and a "function-behavior-structure" model (FBS model for short) is proposed. Both models try to solve the problem of product structure solution from the perspective of function. But the above two models lack the characterization of the complex motion behavior in the mechanical system, it is difficult to solve the complex mechanism scheme problem and it is not conducive to the realization of computer-aided scheme design.

Based on the FBS model, according to the characteristics of the machine, especially the working machine, to realize the transfer and transformation of mechanical movement and complete the transformation of mechanical energy, a "function-behavior-action-structure" model (referred to as FPAM model, F is function , P is the technological action process, A is the action, and M is the mechanism). The FPAM model also takes functions as the starting point, but it highlights and emphasizes the decomposition and conception of the process of technological action, more suitable for the design features of mechanical motion scheme. In addition, because the FPAM function solving model has strong pertinence; there is a certain regular mapping between the execution action and the execution mechanism; each execution mechanism can be compared to a certain degree. Therefore, this functional solution model will be conducive to the development of computer-aided design, making it possible for mechanical system design to enter a certain degree of intelligence and automation. In this sense, the FPAM function solving model can promote the innovation of mechanical system design. The principle of the FPAM function solving model is based on the function of the machine. On the basis of determining the overall function of the machine, to conceive the process of technological action, decompose the process of technological action, and determine the execution action. Solve the execution action and the corresponding actuator, and then complete the combination of the actuator system to achieve the design of the actuator system. The starting point of the FPAM model is the analysis of market demand and the determination of the overall function of the product; then the conceive of the process of technological action, the concept of the process of the process of action is closely related to the difference in the selected working principle; the second is the decomposition of the process of technological action, the process of decomposition consistent with the constraints of the simplest action, the feasibility of the action, and the minimum number of actions; after performing the action decomposition, it is necessary to find the corresponding mechanism solution for performing the action from the mechanism library. The search of the mechanism solution is the key to the design of the motion plan. as shown in Figure 2[23].

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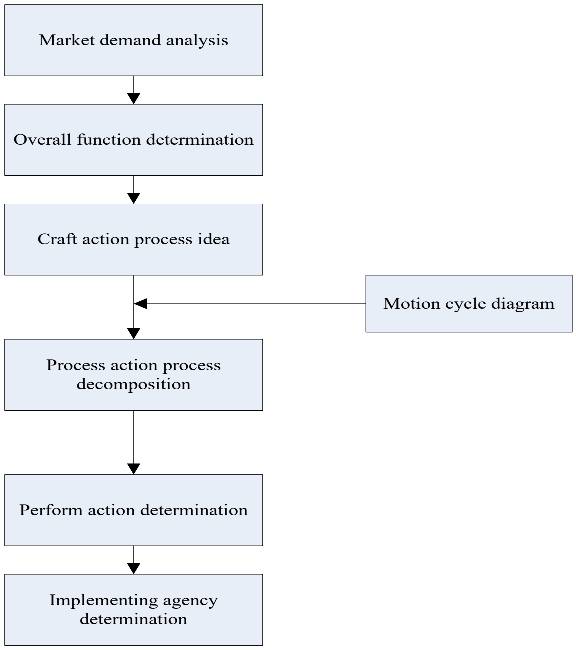

Figure 2: FPAM functional solution model

2.3. Thinking Method of Mechanical Innovation Design

We often refer to the process of thinking as "thinking" because the path problem can be used to illustrate the human thinking process[24]. This article proposes two principles of mechanical design innovation:

(1) Similarity association

Associative ability is the creativity that finds the similarity between things. Similarity refers to the internal connection between things. However, it is difficult to use computer systems to help designers find similarities in nature. The mechanical design process ranges from functional requirements to functional mapping to physical mapping. In CBR systems, functional requirements, working principles, and physical structures are used as indexes, so they can be collectively referred to as index entries. A combination between different types of the same index is called a vertical combination, and a combination of similar indexes of different indexes is called a horizontal combination. Functional requirements are the starting point of Lenovo. Experienced designers usually learn a lot of design patterns, so they can understand the similarities between vertical and horizontal directions, and can quickly and effectively combine horizontal and vertical combinations. Find combinatorial optimization (finally referred to as an example), and then find the optimal solution.

(2) Shortest path principle

After obtaining the functional requirements of the product, designers usually approach the goal with the best design examples, and then use value engineering methods to analyze object conflicts to find few low-cost components as research objects. If you cannot resolve a specific conflict, plan to make a large change or expand the scope of your research and ultimately get the best results. The energy consumed in this way reflects the principle of the shortest path[25].

3. Experiments

3.1. Experimental Object

In the course of this research, the automobile cover mold was used as an example for analysis, mainly to analyze the application and effect of computer-aided technology in the process of mechanical design and manufacturing. In the process of automobile design and manufacturing, the most critical work link is the design of automobile cover molds, and the quality of the design effect will directly determine the quality of the automobile cover molds, then it has a decisive influence on the design and manufacture of the whole automobile. As a mechanical designer, in the process of designing automobile cover molds, there will generally be deviations between the physical shape and the specific construction. Once this problem is found, it must be reworked, which will extend the design cycle and product production time. Moreover, it will also increase the design cost of automobile cover molds, which weakens the market competitiveness of enterprises to a certain extent and hinders their long-term development.

3.2. Experimental Design

Take car door design as an example to carry out specific analysis. In the process of car cover mold design, the design process of computer-aided technology is as follows:

(1) Design automotive parts. With the help of computer-assisted technology, you can build a geometric model of the car door, and then choose a geometric model that matches it, to ensure the overall quality of the auto parts;

(2) Use specific measurement methods to analyze the constructed geometric model and do a good job of collecting and processing related data;

(3) Using computer-aided technology to complete the reconstruction of the existing model, and can also effectively control the CNC machining of the mold, thereby improving the efficiency of automotive door design and processing.

3.3. Experimental Measures

(1) Auxiliary drawing design

The CAD system in computer-aided design has certain flexibility, which can provide designers with new design solutions, can match higher-level designs when they have a fixed part configuration, and it takes less time to match them to the design, which can effectively avoid parts and design errors. Therefore, the application of computer-aided mechanical design in mechanical design can improve design efficiency, give full play to its due functional value, and meet the country's development of mechanical design.

(2) Part and transfer design

The mechanical design mainly includes wire frame, surface and solid design. Computer-aided mechanical design can effectively calculate the three designs, so that more advanced technology can be used to complete the design, thereby promoting computer-aided mechanical design. Improve the design level of parts and transfer drawings.

(3) Detail inspection design

Blocking the mechanical design by the computer can play back the part design, so that the entire mechanical design details can be displayed. In this way, designers can effectively check the errors and modify them in time to improve the quality of the design, avoid errors that affect the design work, and maintain the feasibility and efficiency of the entire design.

(4) Fit the thinking of related designers

When using computer-aided mechanical design, the staff can first outline the content in the brain, and then use a three-dimensional method to show it, prepare for the design work, and finally use computer-aided mechanical design functions to complete the design, which can effectively helps designers to perfectly display the design in their minds, so that people can intuitively feel the different characteristics of the same graphic, so as to meet the designer's thinking requirements.

(5) Improve design quality and level

Applying the auxiliary mechanical design in the computer to the design activities can retain the original idea and use simple two-dimensional graphics to present it, which can effectively meet the designer's ideas, and the design can be processed by the complex computing programs in the computer. It doubles the design efficiency and is more advanced than the traditional design mode. Therefore, the use of computer-aided mechanical design can improve design quality and designer level.

(6) It is more convenient and quick to modify the design

There is also a special function in computer-aided mechanical design. It is easy to make certain mistakes in the design process. It is difficult to modify the traditional mechanical design in the original

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drawing, which causes the graphics to be invalidated and wastes the working time of related personnel. However, the computer-aided mechanical design can be modified in the original drawing when an error occurs, which effectively saves working time and can fully cooperate with the original parts. Therefore, the use of computer-aided mechanical design is relatively fast and convenient.

4. Discussion

4.1. Analysis of Experimental Parameters with Traditional Auxiliary Engineering

Computer-aided work is performed in a static state to determine the working efficiency of automobile cover molds, thereby determining the working status. Automotive cover molds have multiple engineering links, and auxiliary engineering can integrate these technologies organically, integrate information, to improve the life cycle of engineering products, the computer-aided engineering must not only integrate the technical requirements of relevant personnel, but also combine information flow and logistics, so the work process is quite complicated. In order to test the actual computer-aided engineering of the automotive cover mold system studied in this paper, the working effect needs to be compared with traditional auxiliary engineering. The parameters obtained through comparative experiments are shown in Table 1.

Table 1: Experimental parameters

project	parameter
System type	computer system
Programming language	CAJ language
Display image	3D stereo image
Tracking system	Dynamic Monitoring
Management style	Centralized management
working environment	UMS
Allowable error	0.6%-1.6%
Drawings	Two-dimensional image
Number of subsystems	18-28

4.2. Comparative Analysis of Traditional Engineering and Computer-Aided Engineering

Computer-aided engineering designs engineering drawings of various types of automobile cover molds in the simulation system, constructs three-dimensional stereoscopic images based on the engineering drawings of mathematical model evolution, and displays them on the display. The designed artwork can be modified directly on the computer, greatly reduce work costs, increase product production speed, conduct experiments according to experimental parameters, choose traditional engineering and computer-aided engineering to assist the same automobile cover mold work, so as to analyze the cost, time and work results of mechanical work compare the two ways.

(1) Expenses

When the workload of the mechanical system is 20J, the cost consumed by the traditional method is 60,000 yuan, and the cost of this method is 13,000 yuan; when the workload of the mechanical system is 60J, the cost of traditional method is 85,000 yuan, the cost of consumption is 46,000 yuan; when the workload of the mechanical system is 120J, the cost of the traditional method is 93,000 yuan, and the cost of this method is 55,000 yuan, as shown in Figure 3.

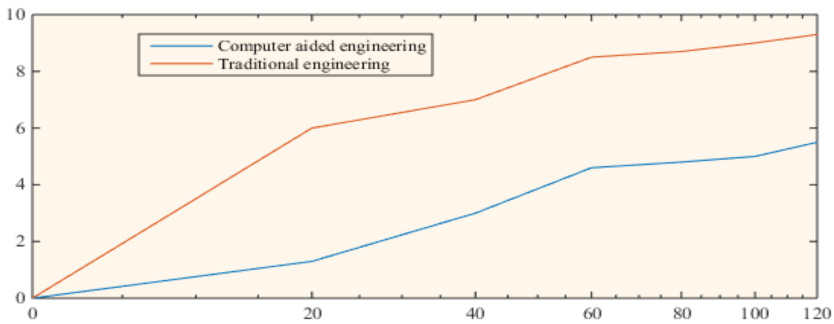

Figure 3: Cost comparison results

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(2) Time-consuming

When the workload of the mechanical system is 20J, the time consumed by the traditional method is 30min, and the time consumed by this method is 10min; when the workload of the mechanical system is 60J, the time consumed by the traditional method is 50min, and the time consumed by this method is 15min; When the workload of the mechanical system is 100J, the time consumed by the traditional method is 60min, and the time consumed by this method is 25min. As shown in Figure 4.

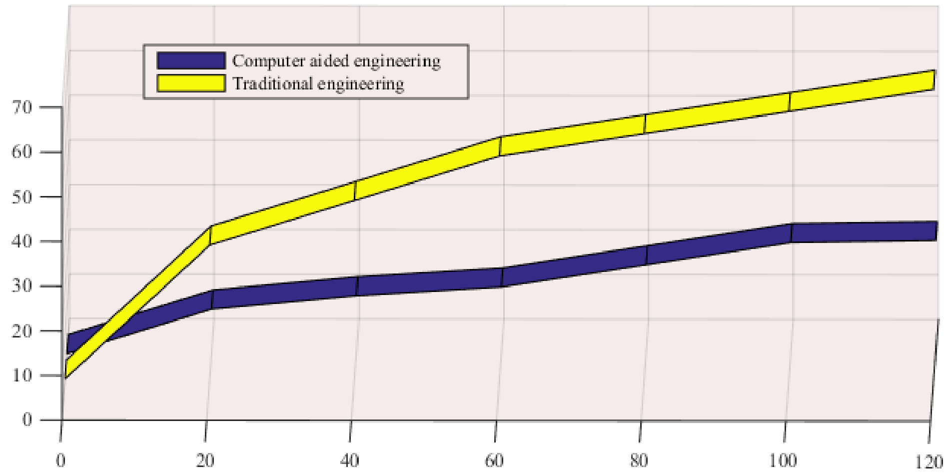

Figure 4: Time spent comparing results

4.3. Analysis of the Actual Work of Traditional Engineering and Computer-aided Engineering

When the working time is 20 minutes, the working efficiency of the traditional method is 22%, and the working efficiency of this method is 46%; when the working time is 40 minutes, the working efficiency of the traditional method is 60%, and the working efficiency of this method is 70%; When the working time is 60min, the working efficiency of the traditional method is 70%, and the working efficiency of this method is 93%. As shown in Figure 5.

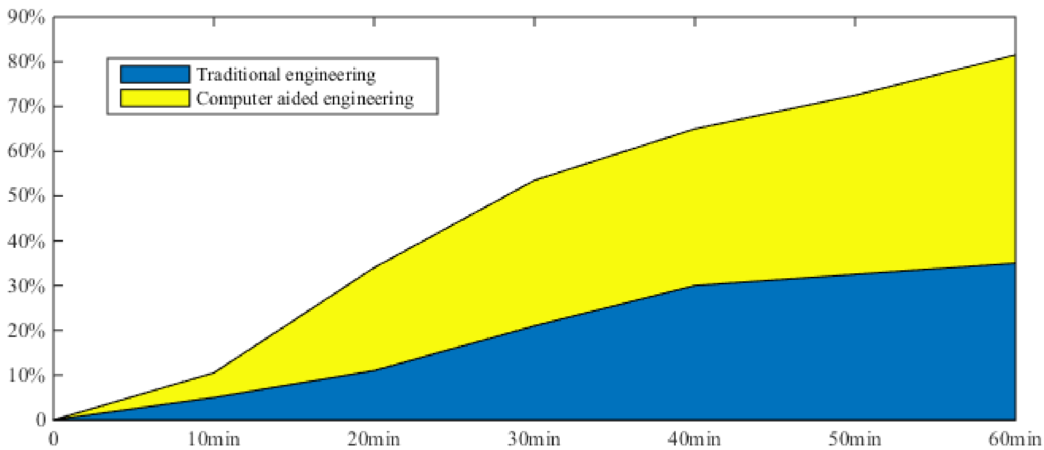

Figure 5: Working effect of decision support system

4.4. Computer Aided Engineering Stability Detection Analysis

By comparing the stability of traditional engineering, electric carrier-based electronic mechanical starter temperature control system (referred to as electric power carrier temperature control system) and phase change material based electronic mechanical starter temperature control system (referred to as phase change material temperature control system) , to verify the reliability of the computer aided engineering results in this paper. In order to observe the results more intuitively, the results are described with reference to Figure 6.

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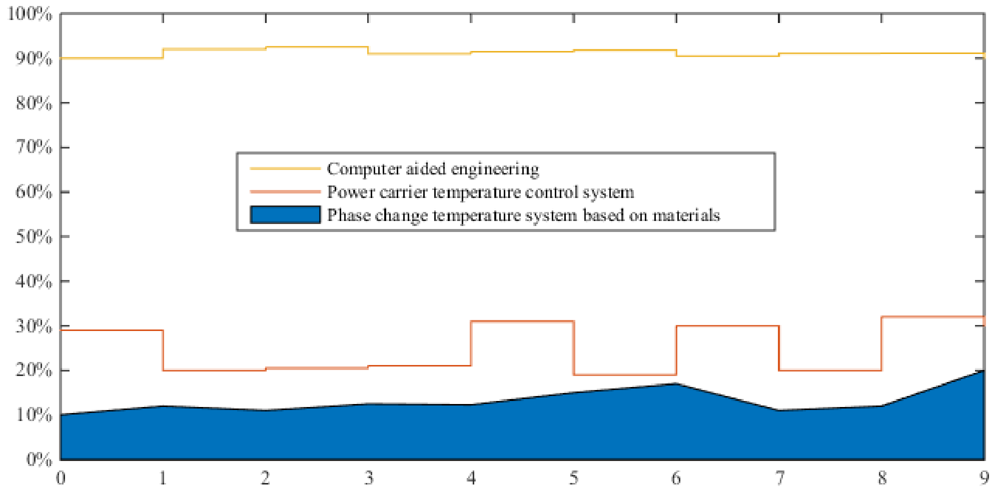

Figure 6: Stability test results

5. Conclusions

This article studies the promotion of China's computer-aided machine design in the continuous development of science and technology in China. There are still some problems in the actual application process. The main problem is that China's science and technology are relatively backward compared with western countries. In view of this development situation, scientific application of the existing computer-aided mechanical design can not only improve the level of mechanical design, but also promote the next development plan of China's science and technology, and provide forward momentum for the development of China's computer industry. The application of computer-aided technology in mechanical design and manufacturing can improve the deficiencies and defects in mechanical manufacturing, develop computer technology, optimize mechanical design and manufacturing, promote the improvement and improvement of design schemes, and ultimately improve the functionality and quality of mechanical products. The needs of the new social environment improve production efficiency. In the process of mechanical design and manufacture, the introduction of computer-aided technology can not only ensure the smooth progress of mechanical design work, but also effectively improve the efficiency and quality of mechanical manufacturing. At the same time, with the aid of computer-aided technology, the defects and deficiencies found in the mechanical design and manufacturing stage can be adjusted and improved in time, so as to better promote the development of the mechanical design and manufacturing industry.

This paper studies that the system can search for principles, dimensions, physical structures, and patterns that can be used to eliminate conflicts by analyzing and combining conflicts and supplementing functional optimization and conceptual design phase optimization. This is a new success of generalized mechanical optimization design methods. New trends in the development of mechanical products: high-tech features characterized by optical-mechanical integration penetrate into mechanical products; product miniaturization, multi-function, intelligence and low cost; the product is easy to manufacture, has a short service life, and is easy to update. Therefore, the development of product innovation activities requires more interdisciplinary knowledge structures, more complex technical support and more innovative design theory methods, and more effective software tools for computer-aided product innovation design. Commercial CAI programs make full use of computer data, fast calculation speed, and reliability and reliability, eliminating artificial opportunities and uniqueness in the process of innovative design, and have become an important technical tool for companies to respond quickly to market and product innovation.

This paper studies that computer technology has become diversified, thereby making design work more convenient. At the same time, the reform of computer-aided mechanical design teaching will help to motivate students to learn, and will also stimulate students' enthusiasm for learning design, so that college students have more and more opportunities for hands-on operation. The teaching method can greatly improve the quality of computer-aided mechanical design teaching in colleges and universities, and then promote the sustainable and healthy development of the specialty. According to the changes and development of the times, mechanical designers should constantly update their mechanical design concepts and master the skills of corresponding computer-aided design techniques. However, because the current development of computer-aided design technology in China is not very mature, we need to vigorously promote the development of computer-aided design technology to promote the rapid development of mechanical design. Starting from the source of mechanical product innovation-changes in product working background and market demand, combining subjective factors such as the designer's experience in design practice, product innovation is considered as an orderly mapping process between several sets of variables that originate from environmental variables. Based on this, a dynamic model of S variable set mapping is established and 4 typical innovation process frameworks--innovation chains are summarized; in order to achieve the needs of computer-aided conceptual design, a mathematical model of the innovation chain is established using the corresponding matrix of a directed graph. The sparse symmetric matrix model of the entire conceptual design inference process is proposed above, which provides the necessary support for creating a complete computer-aided conceptual design inference system. Because the computer-aided conceptual design inference system has broad application prospects, the proposed method will significantly improve the efficiency of the conceptual design inference process.

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