Application of modeling and analysis technology of mechatronics system in mechanical engineering

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Abstract—In the context of the rapid development of the global economy, different enterprises in the process of development, will be fully applied to various economic order, which improves the comprehensive competitiveness of enterprises. The innovative application of mechatronics system in mechanical engineering industry can promote the modernization and information development of mechanical engineering industry to a certain extent. In this process, we need to ensure the efficiency and reliability of mechanical design, so as to solve various problems existing in the design of the current mechanical system and electronic system. At present, in the development process of mechanical engineering, to fully apply the modeling and analysis technology of mechatronics system, it is necessary to understand the corresponding application principles, build the modeling and simulation application platform of mechatronics system, and carry out the joint simulation analysis of mechatronics products. Only in this way can we effectively solve various problems existing in the process of electromechanical operation of the model and ensure the design level of mechanical engineering.

1. INTRODUCTION
At present, in the development process of mechanical engineering enterprises, there are some problems in the separate design of mechanical design and electrical system, mainly manifested as long design and debugging cycle, high cost and relatively poor reliability, which will hinder the long-term development of mechanical engineering to a certain extent. Based on the modeling and analysis technology of mechatronics system, the mechanical engineering design scheme is simulated and analyzed to deeply explore the specific performance of the mechanical system in the operation process and the characteristics of the linkage operation. Modeling and analysis technology of mechatronics system can optimize and improve the design scheme according to the actual situation, which can not only reduce the cycle of mechanical engineering in the design process, but also ensure its stability and reliability, and reduce the cost of mechanical engineering design and production.

2. OVERVIEW OF MECHATRONICS
Mechatronics system refers to the new mechanical engineering technology formed by the comprehensive application of information technology, electronic engineering technology and other advanced technologies. As a new technology, mechatronics system can promote the long-term development of mechanical engineering industry to a certain extent. At present, in the process of the development of mechatronics system, it is necessary to combine the microelectronic system and mechanical system effectively, and give full play to the application value of mechatronics system through software. In the process of application and development of mechatronics system,
mechatronics system because of the type of technology used is more complex, there are some drawbacks in the application, so we must solve these problems before we can further develop. Mechanical and electrical integration of the main application problems in the following aspects: first, information processing technology in the application process there are some drawbacks. For the application of information processing technology, it is necessary to ensure the integrity and accuracy of information processing, in order to ensure the overall operation efficiency of mechatronics system. At present, in the application process of information processing technology, it is necessary to comprehensively analyze the reliability and anti-interference in actual operation, so as to improve the application benefit of information processing technology. Secondly, there are also some problems in the application of detection and sensing technology. The application of detection and sensing technology requires relatively high precision and sensitivity. In order to give full play to the application advantages of detection and sensing technology, it is necessary to comprehensively apply various information receiving technologies to receive sound, light, electricity and other information data. In the actual process of exploration, we need to use some working principles or construction design to solve the problems in the application process of mechatronics system. Thirdly, there are some problems in the application of control technology. In the design process of mechatronics system, the precision of positioning control should be improved as much as possible to ensure the control efficiency. In this case, an accurate and comprehensive analysis of the automation technology and control methods is required. Especially in the optimization of automatic control system technology, it is necessary to comprehensively consider the shortcomings and defects existing in the technical operation, in order to achieve the automatic application of mechatronics in the mechanical engineering industry application process, promote the further development of mechatronics system [1].

3. OVERVIEW OF modeling and analysis technology of Mechatronics System

When the mechatronics collaborative modeling and simulation analysis technology is applied in mechanical engineering, it is necessary to complete the construction of the high-level architecture of modeling and simulation. At the same time, it is necessary to build the data standardization system and the data information interaction system to ensure the application value of the mechatronics modeling and analysis technology. In collaborative modeling, we should pay more attention to the construction of high-level architecture of modeling and simulation. This architecture is mainly oriented to modeling and simulation analysis objects, which can complete 3D modeling and simulation analysis operations, independent modeling for each module, and joint simulation. Modeling and simulation high-level architecture can promote the independent update and upgrade of different modules in the actual application process, to ensure the accuracy of the analysis results of the mechatronics collaborative modeling system and the superiority of the whole system operation [2].

In the application process of mechatronics collaborative modeling, the rapid integration and configuration goals of packet modules can be realized according to the actual needs of specific industries. In the process of operation analysis, it is not necessary to fully consider the application rules of the modeling object. It is mainly concerned with the various situations of the combination and cooperative operation of the mechanical and electrical models. It is possible to integrate the local package modules into the overall system. The main application advantage of this structure is that it can realize distributed co-simulation analysis in multiple computer systems, which can improve the efficiency and accuracy of mechanical design co-simulation analysis. In addition, in the application process of modeling and simulation of high-level architecture, different alliance members and RTI operation support system can form a strong open mechatronics collaborative work platform to ensure the scalability of the whole system. When the modeling and analysis technology of mechatronics system is applied in the mechanical engineering industry, its main theoretical structure is shown in Figure 1.
4. THREE, MECHATRONICS SYSTEM MODELING METHODS

In the application process of modeling design technology of mechanical engineering mechatronics system, it is necessary to ensure the effectiveness of the modeling method of mechatronics system with the help of computer. The modeling and analysis technology of mechatronics system mainly abstracts the mechatronics system into a physical model and displays it on the computer. Physical models that can be expressed and described can be formed in a computer. In addition, it needs to be transformed into a mathematical description that can be used for simulation analysis of existing objects. At present, the computer aided mechatronics system modeling methods mainly include the following: first, block diagram modeling. This modeling method is developed on the basis of control theory and can effectively model the output and input processes of signal flow. There are many basic control modules in the application of block diagram modeling technology. Such as integral, proportional integral, differential, proportional differential and other theories. In modeling, these modules need to be effectively connected by line segments. Each module is composed of transfer functions, and any control system can be expressed through feedback modules and conventional modules. Second, the system diagram analysis technology. This analytical technique is based on the theory of line graphs. System diagram refers to the topological structure line diagram of system energy flow. Researchers can effectively combine the line diagram and block diagram, which can complete the description and expression of system structure containing information flow, and can effectively describe the system diagram. The system diagram method is similar to the bond diagram method in that the modeling analysis is performed by using the least common elements that model the system behavior in the entire energy domain. Each element can be connected by energy bonds to describe the direction of the energy flow of the system. Third, object-oriented modeling and analysis technology. This analysis technique is mainly used to model and analyze design objects in the field of mechanical engineering and electronics. It can be applied in different databases and in different directories. The main characteristics of the object-oriented modeling and analysis method are inheritance, hierarchy and data encapsulation, which can reduce the errors in the process of modeling and analysis, and can be used again. At present, the application of this modeling and analysis method is the most common technique in the application process of mechanical and electrical engineering modeling and analysis technology. Object-oriented modeling requires decomposing the object into the smallest object that can be expressed in mathematical form, and then encapsulating the decomposed object and using the way of icon to save the object and make it an object graph. The smallest object graph can be combined in a specific form to complete encapsulation and produce a physical object model. The established object graph can be extracted when needed in the modeling process of other object models. The bottom end of the object graph can be described in the process of using modeling software. This modeling method can not only complete the mechanical system modeling, but also can effectively model the control system. Therefore, object-oriented modeling method is an important way to promote the application of modeling and analysis technology of mechatronics system in mechanical engineering [3].
5. Modeling and analysis scheme and interface confirmation of mechatronics system

5.1. Modeling and analysis scheme
In mechanical engineering, the rationality of the modeling scheme must be guaranteed when the modeling and analysis technology of mechatronics is applied. UP M modeling scheme is the main scheme type in the application of modeling and analysis technology. UPM is a unified product model. The UPM product model can not only present the data information of mechanical engineering products in the whole life cycle, but also improve and merge the properties of the whole model in different design stages to ensure that the data information expressed by different mechanical parts is highly unified. In the application process of this modeling scheme, the scalability is relatively strong, which enables the product to be adjusted and transformed in different stages. In actual design work, designers need to construct product attributes and corresponding structural information from UPM model. In the development operation, the model attributes and structure should be improved and modified according to the actual requirements of mechanical engineering. The entire design and development team can conduct modeling operations in the same model library, and some information changes can be reflected in the neighboring structures, and the designers of the neighboring structures can modify and optimize the matching structures according to the product information after changes. This modeling scheme can complete modeling and analysis to a great extent, and can carry out bottom-up integrated modeling in the whole process of modeling and analysis, and can ensure the unity of product data. The specific operation process of UPM unified modeling scheme is shown in Figure 2.

![Fig. 2 Operation flow of UPM unified modeling scheme](image)

5.2. Confirmation of modeling interface
In the process of joint analysis of mechatronics modeling, different simulation and new software should be run jointly. In order to achieve the goal of joint operation, a universal, integrated and high-speed data and information interface is needed. In the design of this interface part, special joint lightning protection interface software can be set up, so that different application modules can be organically connected and analyzed. In order to complete the data communication demand in the process of co-simulation analysis, the data interface needs to be designed according to the specific situation of the data communication demand. In the process of co-simulation analysis, the amount of data communication is relatively large and the requirement of data transmission capability is relatively high. Therefore, in the specific design process, bus data communication module can be given priority to, and different simulation modules can be connected uniformly. Use a unified data interface to enable it to connect to the data bus. And under the control of the computer bus can realize the data communication between different modules and data transmission goals. At present, the international common communication standard of the Joint Data Simulation Bus is the high-level architecture standard of modeling and simulation [4]. This standard can ensure that every simulation analysis software can complete efficient data transmission and conversion work, and has become a data communication mode strongly promoted by the international standard. The specific communication structure is shown in Figure 3.
6. Mechatronics modeling and simulation software

At present, in the process of electromechanical integration technology application system modeling analysis, simulation software used by the system mainly include the following two kinds: first, the software 20-sim can complete the simulation analysis of mechanical system and electronic system and modeling analysis, is applied in the process of mechanical and electrical integration modeling analysis common important software. The software is Sidops language can use block diagram and bond diagram for modeling, has its own design model library. There are many modeling directories covered in the model library, and a complete model has been established in the catalog, which users can call according to their own needs. In addition, in the process of application of the simulation software, users can also model according to their specific needs. However, SIDOPS language is needed to describe the 20-sim model. This software can effectively merge the block diagram with the bond diagram. When the user completes the modeling of the control system by using the block diagram, he can also use the bond diagram to model and analyze the mechanical part of mechatronics. Second, DyModa software. This software is mainly used in the field of automotive engineering and robot engineering simulation modeling. The simulation software allows for hybrid modeling and simulation analysis in different fields simultaneously. For example, the electronic field and the mechanical field are mixed simulation. As an object-oriented modeling and simulation software, the language used in the software is Modelica, which allows bond graph modeling and can effectively combine bond graph with block graph, with relatively strong intuitiveness. Compared with 20-SIM, non-professionals can also use this software for modeling in the design and development process, which is mainly determined by the highly abstract performance of the bond diagram itself [5].

7. The application direction of mechatronics system in mechanical engineering

In order to promote the stable and long-term development of mechanical engineering, the mechatronics modeling and analysis technology must be applied in the mechanical engineering design and manufacturing process. In the application process of mechatronics system, mechatronics modeling and analysis technology should be promoted to develop in a more advanced direction. In this case, it is necessary to further explore the main application direction of mechatronics system in mechanical engineering. First, in a variety of theories and technology continue to mature and improve the background, the application of mechatronics system in mechanical engineering will develop in the direction of more intelligent. With the continuous development of science and technology in China, the application of various advanced technologies in different industries is also more common. Intelligent technology has become an important type of technology that can not be ignored in the modernization development of all walks of life. In the future development process of mechatronics system, high intelligence must be reflected in order to promote the stable development of mechanical engineering. At the same time, high intelligence is also an important basis for the development of mechatronics systems. In the development process of mechatronics system in the future, in addition to the full application of modeling and analysis technology, there will also be a full application of more high intelligent technology, which is of great significance to the intelligent development of the whole mechanical engineering. Second, in the future of mechatronics system development process, its green ecological environmental protection will be more and more strong. With the in-depth development of ecological civilization construction in China, more and more attention has been paid to ecological
benefits in the process of mechanical engineering development. The application of various green environmental protection measures is also more common. In the mechatronics system development process, the concept of green environmental protection and related technology into the mechatronics system innovation research, can improve the mechanical engineering production process, product use process of ecological environmental benefits. In particular, some products can be recycled efficiently to reduce the waste of resources. Therefore, in the development process of mechanical engineering in the future, when the mechatronics system is applied, green environmental protection is also the main application basis [6].

8. Conclusion
In a word, in the application process of modeling and analysis technology of mechatronics system, various problems existing in the development process of mechanical engineering must be fully grasped, and the linkage analysis of mechanical system and electronic system can be promoted, so as to solve the problem of independence existing in the process of traditional different analysis software. At present, in the development process of mechanical engineering, the full application of the modeling and analysis technology of mechatronics system can ensure the rationality and effectiveness of the modeling scheme according to the practical application requirements of mechanical engineering, which is of great help to improve the efficiency of mechanical design and shorten the design cycle. The effective application of mechatronics modeling and analysis technology can also improve the overall design quality of mechanical engineering products, ensure the design cost, and enhance the overall economic and social benefits of mechanical engineering enterprises. Therefore, in the current mechanical engineering industry development process, the mechanical and electrical integration system modeling and analysis technology has great promotion and application value.

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