The Application Research of Mechatronics Technology Based on Computer in Construction Machinery

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Abstract. With the progress of society, modern science and technology have achieved rapid development, and people's research on mechatronics has become more in-depth. The three technologies of machinery, electronics, and information are organically combined to achieve the purpose of optimizing the system. Mechatronics based on computer technology can give play to the characteristics and functions of various technologies, thereby promoting the improvement and improvement of the quality of mechanical products. Mechatronics technology is the core technology of mechatronics. With the development of this technology, the functional, safety, accuracy, operability, flexibility and other characteristics of electromechanical products are constantly being improved and enhanced. This article mainly discusses and analyzes the application of several integration techniques based on computer technology in modern mechanical engineering.

Keywords: Mechatronics, Modern Engineering, Machinery, Application

At present, China pays more and more attention to the research of mechatronics technology. The advancement of this technology has improved the quality and efficiency of mechatronic products, further improved product functions, accuracy, production capacity, etc., thereby providing more convenience for modern engineering construction and production, Promoted the improvement of project quality and efficiency [1-3]. The mechatronics system consists of five elements: structural composition, dynamic composition, kinematic composition, sensory composition and functional composition [4]. During the application of mechatronics technology, it is necessary to ensure that the five major elements of the system are coupled to each other, which has the functions of motion transmission, information control, and energy conversion, thereby ensuring the effective operation of the system.

1. Research significance of mechatronics technology

At present, many experts and scholars in China are engaged in related research work on mechatronics
technology. The improvement and development of this technology can promote the improvement of the quality of mechatronic products, improve the appearance and functionality of products, and make them more humane and intelligent. [5-6]. Compared with traditional electromechanical products, electromechanical products using this technology have greater use advantages, including the following aspects:

First, the technology can enhance product functionality and expand product use. It breaks the traditional single-technology, single-function product pattern, integrates information and electronics technologies into the product, and gives the product more powerful functions. Not only that, the new electromechanical products can be applied in a variety of occasions and fields, and provide corresponding service content according to user needs, with strong adaptability.

Second, the technology can improve product accuracy. The application of electromechanical integration technology can make the product structure more concise, reduce the original transmission parts, and reduce the movement errors caused by mechanical wear, deformation and other reasons. Not only that, the use of computer detection and other technologies can correct and compensate for dynamic errors, thereby improving the accuracy of use.

Third, the technology can make products more secure and reliable. Products with mechatronics technology have a high level of automation, with functions such as self-monitoring, automatic diagnosis, and protection. Not only can it reduce the potential safety hazards caused by equipment products to the human body, but it can also reduce the incidence of equipment accidents and meet the requirements for safe and reliable use.

Fourth, applying this technology can simplify the difficulty of operation. The use of computers and digital display technology to improve the man-machine interface reduces the workload of manual operations, and also removes operating facilities such as buttons and handles, thereby reducing operating time, reducing manual training costs, and improving the use of mechanical and electrical equipment.

Fifth, the technology can improve product flexibility. That is, the software is used to optimize the working procedures, thereby satisfying the needs of diverse users. For example, industrial robots have higher requirements for freedom of movement, and the gripper part must be equipped with tools for replacement. With this technology, the control program can be used to control the motion trajectory, change the robot's motion posture, and then complete various types of industrial operations.

Sixth, the technology promotes the increase in product functionality, simplifies operating procedures and methods, and comprehensively improves the production capacity, operating efficiency and quality of electromechanical equipment. It can use the mechatronics technology of virtual prototype to design and construct the model, which will also help the research of simulation technology.

2. Technical content of mechatronics applications

Mechatronics is a diversified technology. Mechatronics systems are composed of multiple technologies, including the following, as shown in Figure 1.
First, mechanical technology. This technology is the basic technology of mechatronics. It is mainly used for the adaptation and matching of machinery with this technology. It cooperates with other modern technologies to update the concept of machinery, and innovates and changes mechanical materials, structures, and performance, thereby reducing machinery. At the same time of weight and volume, it improves the accuracy, stiffness and performance of mechanical applications. In the process of establishing the mechatronics system, traditional mechanical theory and process technology can be used as technology, and computer-aided technology, artificial intelligence systems, expert systems, etc. can be used to realize the innovation and transformation of mechanical technology. Second, computer technology. With the use of computer technology, operations such as information exchange, storage, and calculation can be realized, and technologies such as artificial intelligence and neural networks are also within the scope of computer information processing technology. Therefore, computer technology is one of the core technologies of the system; third, system technology. That is, the overall concept is used as the basis to organize the application of various technologies, taking the global perspective and system goals as the fundamental starting point, decomposing the overall to form multiple functional units, and there is a certain relationship between the units. Among them, the interface technology is an indispensable technical content, which can realize the connection of various parts within the system; Fourth, the automatic technology. The automation technology contains a lot of content. Based on the control theory, it designs the mechatronics system, and realizes the operation purposes such as system simulation and field debugging. Among them, the control technology is a relatively core application technology, which mainly includes positioning control, adaptive control, self-diagnosis, correction, compensation and other aspects; Fifth, sensor technology. Sensing technology can be used for system detection and adjustment, which can be called system receptor, which can meet the requirements of automatic control and adjustment. The higher the level of sensing technology, the stronger its use functions, and the higher the level of automation of the system. Modern engineering requires sensors to be able to obtain accurate and fast information under severe operating environments and conditions, thereby ensuring the level of system application.
3. Application of mechatronics technology in modern engineering machinery

3.1. Application in machine tool production

In the process of machine tool production, Z80-CPU software is often used for control and operation. The research of this software is relatively difficult, and it has been widely used in the field of CNC machine tool production. Judging from the development history of China's CNC machine tool production technology, this industrial production method is composed of a variety of different technologies. Among the entire technical system, the Z80-CPU software has the advantages of low cost and high application efficiency, which meets the requirements of The development requirements of China's modern industrial machinery can be further promoted and improved. Compared with other applied technologies, this technology also has the characteristics of saving energy and controlling pollution, which can ensure the stability of system operation, and then lay a good foundation for subsequent production. In the process of practical application, the technology has high requirements on the workbench and props. In order to ensure the quality of the application, we must start from the following aspects: First, clarify the direction of the coordinate axis operation and ensure that it is consistent with the direction of the workbench and props. It is also necessary to ensure the continuity of the interpolation function; secondly, to give full play to the function of the fluoroplastic veneer guide rail, control the friction coefficient of the guide rail, enhance the wear resistance of the guide rail, and thereby improve the operating efficiency of the data machine; finally, if low-speed operation is not required, The operating cost of the machine tool is low. If the operation speed is fast, the data machine has the advantages of stable and accurate application. At present, the common data machine tool stringing method in China is the ball screw compound drive.

![Diagram of machine tool production](image)

**Figure 2.** applied to machine tool production

The formula for machine tool production is shown in formula (1):

\[ T = (D1 - D2) \times 1.24/FS \quad (1) \]

Among them, D1 is the outer diameter, D2 is the inner hole, L is the length, F is the feed, and S speed.

3.2. Application in automated and semi-automated operations

Mechatronics technology has greatly improved the level of automation and semi-automation, which has promoted the efficiency of mechanical applications, while reducing labor costs, and driving the development and progress of modern engineering in China. Judging from the development of China's modern construction machinery manufacturing industry, the content of manual operations is gradually...
decreasing, and the error problems caused by operating errors are also decreasing. For example, Mitsubishi's automated excavator uses mechatronics technology, reducing the manual operation part, so that the excavator can automatically perform operations such as messaging, operation, and monitoring. This technology can control the electro-hydraulic ratio of the excavator, and it is equipped with an automatic handle, which calculates the electro-hydraulic ratio according to the operation signal, and obtains the control ratio based on the calculation results. Finally, the sensor is used to complete the automatic operation. During the actual construction process, the sensor can be installed on the excavator, and the working condition of the excavator can be grasped in real time. The operator can judge the excavation trajectory according to the display content of the system instrument, and draw the shape of the trajectory. The designed track shape is preset. If the operation content is more complicated, the system can increase the control intensity according to each operation link, and cooperate with the laser technology to strengthen the operation accuracy, thereby ensuring the smooth completion of the mechanical operation.

In addition, the liquid crystal display is installed on the excavator, and the high-recognition display can be used to grasp the mechanical working condition and observe the operation and operation of each part. The operator can operate the control buttons on the control panel and judge the operating status of the machine through the digital display, which reduces the difficulty of operation and improves the efficiency of operation. In addition, under the condition of using the same accessories, the application of mechatronics technology can comprehensively and effectively control the machine, use computer technology to edit the operating process, and make process changes and adjustments according to the actual application. The system can be applied to various types of machinery, and the automatic alarm system and fault detection system can be used to control the working status of the machine in real time, to deal with mechanical failures in a timely manner, and to ensure application safety and efficiency.

3.3. Outlook for future applications

In the development of modern engineering machinery, mechatronics technology has met the development needs of modern society, and has followed the development trend of intelligence and automation. Compared with traditional machinery manufacturing, this technology not only improves product appearance, but also improves product quality and work efficiency, while reducing input costs. It can be widely used in China's medical, scientific, and economic fields.

4. Conclusion

In summary, in the development of modern engineering machinery manufacturing industry, in order to improve the efficiency and quality of machinery, the research on automation and intelligent technology must be strengthened. Mechatronics technology can improve the functionality, operation accuracy, safety, and stability of electromechanical products, meet the needs of modern engineering machinery in China, and increase research and development efforts.

References

[1] Lennart Blanken, Frank Boeren, Dennis Bruijnen., Batch-to-Batch Rational Feedforward Control: From Iterative Learning to Identification Approaches, With Application to a Wafer Stage[J]. IEEE/ASME Transactions on Mechatronics, 2017, 22(2):826-837.
[2] Sergio Aguilera-Marinovic, Miguel Torres-Torriti, Fernando Auat-Cheein. General Dynamic Model for Skid-Steer Mobile Manipulators with Wheel-Ground Interactions[J]. IEEE/ASME Transactions on Mechatronics, 2017, 20(1):1083-4435.

[3] Seyed Farokh Atashzar, Mahya Shahbazi, Mahdi Tavakoli. A Computational Model based Study of Supervised Haptics-enabled Therapist-in-the-Loop Training for Upper-Limb Post-Stroke Robotic Rehabilitation[J]. IEEE/ASME Transactions on Mechatronics, 2018, 23(2):1-11.

[4] Jun Ma, Si-Lu Chen, Nazir Kamaldin. Integrated Mechatronics Design in the Flexure-linked Dual-drive Gantry by Constrained Linear Quadratic Optimization[J]. IEEE Transactions on Industrial Electronics, 2017, 2(99):12-31.

[5] Ernst Csenicsics, Markus Thier, Reinhard Hainisch. System and Control Design of a Voice Coil Actuated Mechanically Decoupling Two-Body Vibration Isolation System[J]. IEEE/ASME Transactions on Mechatronics, 2017, 3(9):25-43.

[6] Tian M, Zhang X W, Zu H Y , et al. General Situation of Construction Machinery Development in Mechatronics Technology[J]. Applied Mechanics and Materials, 2013,2(5), 357-360:2909-2912.