Discussion on the development of mechanical and electrical integration of construction machinery in China

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Abstract: The rapid development of science and technology has changed the engineering application of the model, the backward technology and procedures such as microelectronics, information has been replaced by a variety of new technology, has realized the integration of mechanical products production and application, makes the product more safe and reliable, lower energy consumption amount, realized the high precision products and high quality control, the future will also toward miniaturization, greening, such as direction, product application is more efficient, convenient, and convenient people's life, and provide technical support for the development of various industries. This paper discusses this problem in detail.

1. Introduction
The development of mechanical integration products is consistent with the characteristics and trends of current social development, which can reduce the input of human resources and realize the automatic control of equipment. Reduce the consumption of resources and safety hazards, promote the operation of machinery more safe and stable. However, at the same time, it is necessary to identify the key points of development, strengthen industrial management, make overall arrangements for the work, and achieve further development of mechanical integration.

2. Characteristics
The first is reliability and safety. The integrated product has complete functions, can automatically monitor the entire operation process of the equipment, and send an alarm to abnormal information, fault can be diagnosed and make a protective response. Common faults, including overload and overpressure, are within the protection scope of integrated products, which plays an important role in reducing accidents and ensuring equipment safety. The second is the high quality of work. Integrated products can not only automatically complete the processing and control of information, and the accuracy is very high, covering a wide range, can ensure that the mechanical equipment to implement the key points of the design, to achieve the expected target of action, and will not be disturbed by the operator, significantly improve the product pass rate. At the same time, automation improves production efficiency and can produce more products with better quality in the same time. The third is better performance. Each operation link in the process of operation is mainly by the program control, so you need not set too many buttons, significantly reduced the difficulty and complexity of operation, the whole process is mainly implemented by the electronic control system, can repeat the corresponding action according to production requirements, and be able to independently according to the product model and parameters to determine the most appropriate work procedures, so the final besides high precision, the products produced by using performance is also improved obviously[1].

Fourth, it has a wide range of applications. The technology and functions of integrated products have
been transformed from the original one-way type into a compound type, with more types of functions and significantly improved functional level. In addition to the basic control and protection, but also automatic completion of compensation, inspection and other work. These functions are critical in multiple contexts and domains, and can change depending on the user's needs. This makes the scope of application of integrated products significantly expand on the original basis, and with the continuous improvement of automation level and gradual improvement of functions, it will be applied to more fields, provide users with more high-quality services, and meet the needs of users in many aspects. The fifth is maintenance convenience. Debug products only need to change the program, so you can according to customer demand change the way of implementation, the operation mode is not the advantage of replaced parts, therefore more flexible, simple maneuverability stronger, if the product can store, in which can enter multiple executable program, and then in relation to the work object, connected by code signal, when the change executable program so simply enter the corresponding code[2]. If there is an error in operation, the product can self-check and complete fault treatment, so that the integrated product can be restored to normal operation as soon as possible.

3. Development history
Mechanical integration is a kind of integrated system integrating mechanical and electronic technology, realizing the comprehensive application of electronic, sensing, interface, programming and other advanced technologies, so as to achieve the functional objectives set to meet the production requirements, realize the optimization of each functional unit, more reasonable layout. In addition to being of higher quality and more reliable, energy consumption has also been significantly reduced. In addition, compared with traditional mechanical equipment, mechanical integration products have more complete functions and can automatically display and record, adjust and control.

In the process of the initial research, due to the low level of electronic technology, although which has been applied to mechanical products, but they did not realize the effective combination, limited to shallow, but in the later as the rapid development of the advanced technology such as computer, communication, provides a technical support, a combination to achieve a deeper integration, and currently the development of new technology, such as artificial intelligence, optical fiber technology in improving the performance of mechanical products, has played a vital role. From the perspective of the world, the research on mechanical integration started before the 1960s, and has been effectively applied in the world war ii and the post-war economic recovery. Then, it began to flourish in the 1970s and gradually moved towards intellectualization in the 1990s [3]. Relatively speaking, in this research in China starts late, time for the 1980 s, but since the country attaches great importance to this aspect research, makes the mechanical integration of research results are very significant in a short time, it also with the five-year plan, 863 plan such as many national development plan will be included in the technology has important relation among them. In addition, many colleges and research institutions have also absorbed many advanced foreign experience and done a lot of work, thus accelerating the speed of research, and many enterprises have also played a great role in promoting this aspect. However, compared with some more developed countries, China still has a large gap in this regard, so more resources and costs should be invested to constantly narrow the international gap.

4. Specific application
The first is monitoring applications. Integration includes hydraulic, transmission, braking system, it can be integrated into the machine monitoring, integrated technology in the presence of abnormal situation can be issued a warning, avoid failure for a long time not badly damaged, processing equipment, and currently in the process of engineering construction monitoring work is critical, and integration is one of the most advanced and reliable monitoring method, can realize automatic restoration and protection of the monitoring system, to ensure that the project could be carried out orderly. The second is diesel. For a long time, people have focused on how to improve the fuel consumption rate and solve the pollution problem, so as to achieve equipment optimization. However, the application of integrated technology is conducive to reduce exhaust emissions, promote better
power performance of equipment, and achieve cost savings. At the same time, it can also automatically control the throttle, complete heating and starting up and other operations, and significantly improve the mechanical power, reduce the emission index. The third is sensors. For example, the role of sensors is very critical when paving work is carried out, which can automatically sense the direction, Angle and other parameters, so as to make the pavement more level and thickness consistent with the design requirements. If integrated technology can be integrated into the sensor, the sensor performance can be further extended to ensure its corrosion resistance, pressure resistance and more stable and reliable \([4]\). The fourth is the numerical control machine tool, belongs to the integration application typical, the localization accuracy greatly enhances, by our country independent research and development numerical control machine tool minimum resolution achieves 0.000001mm. Table 1 shows the accuracy of different types of CNC machine tools at present. It can achieve high precision control and intelligent operation characteristics, and the structure layout is more reasonable. Fifth, precision control, precision and enterprise benefits are closely related, even a small deviation will make the accuracy and quality of products are seriously affected, and integration can achieve the monitoring and control of parameters and data. For example, when mixing concrete, raw materials need to be weighed, but if more traditional measuring tools are used, errors will be inevitable. In this case, if the electronic weighing system can be used, accurate weighing can be achieved, and the service performance of concrete can be fully guaranteed while reducing errors.

Table 1: Precision of Electromechanical Integration CNC Machine Tool

| Ordinary CNC machine tool | Submicron numerical control machine tool | Nanometer numerical control machine tool |
|---------------------------|----------------------------------------|-----------------------------------------|
| 0.008mm                   | 0.0005mm about                         | 0.005~0.01μm                            |

5. Developing trend

At present, the integrated products developed have the characteristics of intelligence and networking, so the future development direction will be miniaturization, systematization and greening. The first is miniaturization, that is, the manufacture of products of smaller size, which requires less than 1 cubic meter, but at the same time must have extremely high performance, and is still in the direction of micron, nano and other smaller volumes, providing great convenience for the development of military, medical and other industries \([5]\). The advantages of this kind of product are mainly reflected in low energy consumption, easy to carry, strong flexibility and other aspects, which is also a major direction of current research. The second is systematization, that is to achieve flexible restructuring of mechanical products, meet the actual needs of engineering construction, promote more flexible and practical products, and achieve efficient control of subsystems, and constantly improve product performance. The third is greening. At present the rapid development of modern society in various fields lead to energy consumption too fast, effective resources dwindling, at the same time also caused serious damage to the environment, the concept of saving energy and reducing consumption in each industry should be, otherwise it is difficult to realize the sustainable development, and production of the integration of green products should possess high recycling, environmental protection, resource utilization, harmless to human body health and other advantages. The following table summarizes the development trend of mechanical integration. See table 2.

Table 2: Development Trend of Mechanical Integration

| Development direction | Specific characteristics               |
|-----------------------|----------------------------------------|
| Miniaturization       | Small size, low energy consumption, easy to carry, flexibility |
| Systematic            | Flexible reorganization, practical, control subsystem |
| Greening              | Recycling, environmental protection, high utilization of resources, harmless to human health |
6. Development strategy
In addition to strengthening the development of mechanical integration, we should also formulate some effective development countermeasures, so as to achieve targeted improvement. To be specific, it can be adjusted from the following aspects. The first is overall coordination. At present, there are a large number of research and development units in this field in China, and relatively complete development strategies and plans have been formulated. However, they are limited by their own perspectives to a certain extent, and they pay too much attention to local interests, which leads to unreasonable overall arrangement and failure to measure from the perspective of authority. Therefore, relevant institutions now need to understand the market demand and the development trend of the country in this respect, from a global perspective, make a reasonable research and development plan, and do a good job in the coordination of the interests of all parties. The second is strong support. At present, it is necessary to strengthen publicity through network platforms. Government departments should actively allocate resources and elements to facilitate the research work of enterprises and provide policy support. At the same time, some products with excessive energy consumption must be eliminated, and the direction and path of technological transformation for traditional industries should be provided. Special funds should also be set up to provide economic support for research work.

Third, the machinery integration industry involves a very wide range. However, in view of the current situation in China, human resources, economic resources and other aspects are very limited, so it is difficult to cover all aspects. In this case, the most important thing is to highlight the key points and make a reasonable choice. Traditional industries should be actively reformed, while new products should be adjusted from the design link to fully integrate mechanical and electronic technology, so that there is no need to make too many changes in the later production process, so as to produce products with truly integrated characteristics. Fourth, strengthen industrial management. The establishment of a specialized regulatory body is responsible for making plans and reasonable layout, combining with market demand to transform products with low technical level and serious environmental pollution, and starting from multiple aspects such as function, performance and cost, so as to promote the traditional machinery industry to make changes according to the characteristics of the development of the Times.

7. Conclusion
In a word, mechatronics is an inevitable product of the rapid development of science and technology. In the future, with the continuous research and development of new technologies, more advanced technologies will be integrated into construction machinery, so as to continuously expand the application scope of mechatronics and provide more convenience for the development of society. At the same time, the research work in this area needs top talents, so it is necessary to strengthen the efforts of talent training, and provide strong support for the research work.

References
[1] Xiong Xiaoyong. Development direction of mechatronics technology in mechanical manufacturing engineering[J]. Fujian Quality Management, 2016, (15):141-143.
[2] Yu Weixia, Wang Heqin. Application research of electromechanical integration technology in construction machinery[J]. Science and Technology & Innovation, 2016, (13):158-159.
[3] Hao Yixu, Zhang Xuze. The development and application of electromechanical integration technology in modern construction machinery are analyzed[J]. Telecom Power Technology, 2018, 35(4):156-157.
[4] Zhang Longlong. Application of construction machinery under the background of electromechanical integration[J]. Scientific and Technological Innovation, 2017, 22(16):128-130.
[5] Wei Songlin. Application analysis of electromechanical integration system in mechanical engineering[J]. Chemical Enterprise Management, 2017, (28):148-149.
[6] Wang Jinguang. The present situation and development trend of electromechanical integration technology[J]. Science & Technology Vision, 2014, (28):75-77.