Research on the Development Direction of Mechanical Automation

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Abstract. This article analyzes the current application and development status of mechanical automation in many aspects, and proposes that the essential difference between the two is that modern machinery has intelligent features, while traditional machinery does not, and at the same time it shows the advantages and benefits of all aspects of its products. The fierce still can meet the ever-changing needs of people in production and life. This article takes the system as a starting point, and through listing examples and combining the technologies related to mechanical automation, it proposes the stage goals of the automation control module and the development direction of mechanical design and automation in future development planning.

1. Introduction
At present, mechanical design, manufacturing, and automation are a new fringe discipline. Its main subjects are mechanical technology and electronic technology. This discipline encompasses a number of technologies that affect each other and promote each other. It is precisely because of the rise of the disciplines of mechanical design and manufacturing and automation that all aspects of the mechanical industry have undergone tremendous changes. Industrial production has evolved from the original "mechanization of machinery" to a new stage of development of "mechanical automation".

To date, the development of mechanical design, manufacturing and automation has formed a unique system of its own, as a new discipline, with the development of the times, its content is always updated to make it more perfect. Mechanical automation is a comprehensive application of multiple technologies, with features such as multi-function, high quality, high reliability, and low energy consumption. It can optimize the entire system.

Mechanical Automation is not simply mechanical technology, nor is it simply combined with other new technologies, it is a fusion technology, with the above mentioned group technology integration, and the traditional mechanical and electrical there is a fundamental difference. The mechanical automation also has the intelligent characteristic, has achieved the human and the hand and the limb extension, has also achieved the human sense organ and the mind extension, thus designed and manufactured the product, a good distinction between automation and traditional technology on the difference.
2. Design Principles of Mechanical Automation

2.1. Meet the functional requirements of the machine

The reason why a product is called a product is because it has a certain main function and can meet people's certain needs. The so-called three major elements of industry refer to matter, energy, and information. In general, the function of a product is to be able to set the processing of the three major input elements and output the required substances and energy with certain characteristics. And information. As shown in Figure 1:

![Diagram](image.png)

**Figure 1.** Functional diagram of mechanical automation system.

Mechanical automation is a comprehensive concept that gathers various aspects of information and penetrates into all aspects. Its existence can effectively meet people's needs, including both technical and product parts, and its powerful function is in particular, technology as a support only emerges through the whole.

2.2. Advanced technology enhances production

Classification based on the system's main components and product differences:

1. Focus on material handling and processing. After the treatment of the three major industrial factors, the main changes are the position and shape of the product. The material processing is called the processing machine, and the transportation function is called the transportation equipment. The advanced technology is used to continuously innovate in material handling and processing Is the new strategic goal of the moment.

2. Mainly related to energy conversion. In this part, we need to innovate mainly power machines and prime movers. The original machinery has disadvantages. In order to make the related development more smooth, it is necessary to carry out targeted development and innovation.

3. Focus on information processing, input information and energy. Mainly output some information. In daily life, we are constantly processing information, including texts presented by various media, sounds transmitted by vibration, or images that need to be artificially acquired.

Reform and innovation is a long-term goal. Under the guidance of advanced technology, it is necessary to check the existing functions, design control and other aspects in accordance with the development of the times, to continuously introduce new features, to continuously develop new functions, and to make original functions more perfect.

In comparisons at home and abroad, China does not lack manufacturing capabilities, while foreign countries can often rely on more advanced concepts to take the initiative in the process of mechanical automation. Innovation is the reinvention of basic principles, analysis of related designs or analysis of various products. After finishing, processing according to different reorganization methods. The functions of metal cutting machine tools can be easily known literally, but because the functions they have are not unique, they must be judged according to the specific situation. In order to meet the different needs of users, their operation methods are naturally different, which ultimately results in There are large differences in practical applications.
It can be seen that there is a very large space for development of mechanical automation and a very wide imagination. In the direction of innovation, we can also make great efforts to strengthen the relevant theoretical knowledge base, rationally use related technologies, and integrate technology and technology. Products are better combined.

3. Application of Mechanical Automation System in Chemical Production

Due to the inconsistency of user requirements, in the actual production, there will be some variables, which will have a certain impact on the product, and the introduction of physical quantities will affect the quantity and quality of the product, which can keep it stable and the relevant production capacity. Be better controlled. The top temperature of the rectification tower is a typical example of the former. In order to obtain qualified products, the top temperature of the rectification tower must be kept at a fixed temperature. The temperature at the outlet of the heating furnace fluctuates within a normal range. The reaction temperature must be maintained at a stable level.

3.1. Research on Boiler Drum Water Level Control

In actual industrial production processes, equipment boiler drums are very common. In the production process, its water level is too high or too low, which will cause danger, which is not conducive to the normal operation of industrial production. In general, insufficient water intake will cause the equipment temperature to be too high, which will reduce the mechanical life and even directly damage. Too much is too late for the machine to vaporize, and the steam quality will be more severely affected.

3.1.1. Single impulse control system. A single-pulse control system is shown in Figure 2. This kind of control system is a typical simple control system. This system has certain disadvantages. The lack of sufficient response time of the inlet water or unstable dynamic pressure causes the water level to shift, making it difficult for the system to operate normally, that is, normal production. However, changes are made based on the original, such as increasing the residence time, then the water level can be guaranteed under certain conditions, which can be achieved in small boilers, which means that normal operation can still be guaranteed, so to some extent in terms of production, relying on this principle can satisfy production when production activities are not strictly required.

3.1.2. Double impulse control system. This system is a system with multiple links. It is classified as a composite control system. It has static feed-forward control and single-loop feedback control. Due to its inevitable interference during operation, such as steam load, Relevant researchers started with the control results and found that if a signal called "steam flow" is introduced into the system, the original defects can be improved. The working quality of the double impulse control system is greatly improved. Figure 3 is the purchased dual impulse control system.
Figure 3. Drum double impulse principle diagram and block diagram

In the connection shown in Figure 3, the output I of the adder is

\[ I = C_1 I_C \pm C_2 I_F \pm I_0 \]  \hspace{1cm} (1)

Where \( I_C \) is the output of the liquid level controller; \( I_F \) — the output of the steam flow transmitter (usually via the square); \( I_0 \) — initial offset; \( C_1, C_2 \) — adder coefficients. The setting of \( C_1 \) is generally 1. The value of \( C_2 \) should take into account the static feedforward compensation, which can be tried on the spot or can be derived by theory.

\( I_0 \) refers to eliminating the interference of the \( C_2 I_F \) term of the system, so that the controller and the adder work under relatively balanced parameters.

3.2. Research on Cooler Control Scheme

As the name suggests, the cooler reduces the heat by cooling, so that the system can work at a calibrated temperature. The structure of the cooler is complex, mainly using the coolant as its heat carrier, and most existing coolants Liquid ammonia is the medium. Due to the important role of the cooler in the system, the author consults various data and analyzes and summarizes the following improvements.

3.2.1. Controlling coolant flow. There are advantages and disadvantages to everything. Even through improvement, this control scheme will still have shortcomings, but thankfully this method has reached a relatively stable level, and the use of cooling metering is more sufficient than in general. The most important point is that compression. The pressure at the machine inlet does not affect it, but unfortunately, there is still room for improvement in this control scheme, and its flexibility needs to be improved, because its evaporation space is difficult to guarantee. In order to make up for the shortcomings of this scheme, this scheme can limit the liquid level to go online, thereby solving the problem of insufficient evaporation.

3.2.2. Controlled gas ammonia displacement. As shown in Figure 4 controlling the system in accordance with the correct process can achieve the operation goals, but there are also disadvantages. The refrigeration system needs to be further improved, and the conditions for implementing functions can be more flexible, not limited to one condition. In addition, the use of cooling capacity is insufficient. Once the liquid ammonia enters the ammonia pipeline, the compressor will cause certain damage. In order for the system to operate normally, a liquid level control system needs to be set up.
According to the above analysis and research, it can be known that the automated system has completely liberated human labor, changed the original mode that requires workers to operate in the field, and has moved to a more convenient new development trend. Relevant operators only need to regulate and perform the main operation. By observing the work, the entire process can be successfully completed. After automation, the greater responsibility of the operator becomes prevention of failures and inspection of operations. In recent years, the industrial development has been rapid. Whether at home or abroad, its momentum has only risen. However, its disadvantages have gradually emerged during the development process. Its harm to the environment has begun to appear in different ways. After that, he put forward the goal of protecting the environment and achieving sustainable development, and shrived to be ecologically friendly while economic development. The relevant specific goals are summarized as follows:

1. Effective use of raw materials to reduce costs from the source;
2. To complete production or even over-provision within the prescribed time;
3. Increase security awareness in an efficient process;
4. Be friendly to the environment.

4. Development Direction of Mechanical Automation

Although our country has made rapid progress in the development of mechanical automation, but the overall development time is not long, but in order to make up for this regret, the state has also called on relevant departments and institutions to support the development of mechanical automation and encourage the development of related technologies. However, compared with advanced countries such as Japan, there is still a considerable gap. The development of mechanical automation is obvious to all, and its achievements in technology and engineering systems cannot be underestimated, but we know that any science is not only two aspects of technology and engineering systems, but also includes basic theory. It can be seen that I have seen mechanical automation in The development of the basic theory of science still needs to be improved. More efforts are needed to complete it. The future development direction has the following points:

4.1. Mechatronics

Traditional mechanical products can't keep up with the times. Only the development of mechatronics can cope with the tide of the fierce competition. If China does not strengthen in this respect, the gap with other countries will become more and more obvious in the foreseeable future. Will face a severe trend.

4.2. Intelligent

Since entering the 21st century, "intelligence" has gradually stepped onto the world stage, and it is called an important development direction of the world. The so-called "intelligence" is based on the
control theory, comprehensively assimilating various disciplines, giving certain behaviors to robots, and to a certain extent, liberating human output. For example, machines can help humans make some shallow decisions in the absence of interference, we can make a preliminary judgment on the problems that occur, or reason with human assistance, and analyze the results. This can make the development of mechanical automation to a higher level.

4.3. Networked
The development of the Internet is very mature so far. From the earliest closed times to the current global village, any industry now begins to move to the Internet, or directly join, or use the Internet platform, or combine it with technical support. All aspects of people's lives have undergone tremendous changes.

As a link, the network speaks of the global economy being linked together, and the production of various enterprises has evolved from the original unrelated to the now-linked Golden Tree. Companies from all over the world compete together. Using the network as a platform, the sales channels of machinery and automation products have been greatly expanded, and information exchange has become more convenient. As long as the quality of its own products passes, product functions are favored. Due to the popularity of the network, it will soon be sold worldwide, resulting in economic benefits. The returns are impressive.

4.4. Miniaturization
Micro-electro-mechanical systems appeared in the 20th century. With the development of the times, they have continued to develop to the micron and nanometer level. This type of products is smaller than the traditional ones, which can be more convenient in practical operation and benefit the staff. The completion of relevant work content in the field will also facilitate the transportation of equipment and reduce unnecessary expenses.

4.5. Green
The industrialization process has a huge impact on daily life. On the basis of a large number of materials, the cost of obtaining materials has been reduced. The industrialization of materials can fully meet the needs of the people, and has made large or small contributions in various fields. But at the same time that people are benefiting, our ecological environment is being damaged, related resources are declining, environmental pollution problems are emerging, and when we realize that environmental problems are becoming more serious and are beginning to threaten people, the slogans of protecting the environment and saving resources begin. Ringing, the concept of green products came into being. The requirements of green products will not damage the ecological environment or cause less harm. It will maximize the use of resources and adhere to the concept of sustainable development. Green water and green mountains are the golden mountains and the silver mountains. The environment is the basic guarantee for economic development. If greening cannot be achieved, human development will stall and the global economy will be restricted.

5. Conclusion
The development trend of modern mechanical automation is obvious to all around the world. Because of its positive significance in many aspects, it has been rapidly developed all over the world. As countries attach great importance to economic development, modern machinery automation that can greatly enhance economic development has attracted the attention of many countries. Starting from various aspects such as design and manufacturing, technological updates, and innovative development, we have created a new era and strive to lead the development of the new era. In the current situation of such fierce competition, if China wants to surpass other countries, it must analyze the current development. It can no longer be limited to the level of technology as in the past. The innovation and development module must be strengthened, while design and manufacturing and technology updates are not forget Continue to develop and work hard. In addition, environmental protection has come to a
close. The development of modern machinery automation must always be carried out around sustainability, environmental protection, and full use of resources.

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