Intelligent mechanical manufacturing technology based on intelligent manufacturing technology

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Abstract. With the development of intelligent manufacturing technology, the application of intelligent machinery manufacturing technology has been widely promoted. Intelligent machinery manufacturing technology is a technology that integrates advanced manufacturing technology and intelligent control technology. It can realize the intelligent control of the entire manufacturing process, improve the manufacturing efficiency and product quality, and reduce the manufacturing cost. Based on intelligent manufacturing technology, intelligent machinery manufacturing technology has been developed rapidly and has been widely applied in various fields such as automotive, aviation and so on. It can achieve the goals of automation, intelligence, high efficiency, and personalization, and promote the development of various industries towards intelligent manufacturing. However, there are still challenges in the development and application of intelligent machinery manufacturing technology, such as the high cost of equipment, the difficulty in controlling the manufacturing process, and the lack of skilled workers. Future research should focus on solving these challenges and promoting the further development and application of intelligent machinery manufacturing technology.

Keywords. Intelligent manufacturing technology; Intelligent mechanical manufacturing process, Automation, Optimization, Efficiency

1. Introduction

1.1 The background and significance of intelligent manufacturing technology

Intelligent manufacturing technology is a manufacturing model that integrates information technology, advanced manufacturing technology, automation technology, material science and technology, and other technologies, aiming to improve production efficiency, optimize resource utilization, and enhance product competitiveness. Intelligent manufacturing technology can not only achieve production automation, digitization, and flexibility but also improve production quality and efficiency through data analysis and optimization.

The background of intelligent manufacturing technology can be traced back to the development of digital manufacturing technology. Digital manufacturing technology has been widely used in the manufacturing industry since the 1980s. Digital manufacturing technology improves production efficiency and quality through digital design, digital processing, and digital management. However, digital manufacturing technology still has some shortcomings, such as inflexible production lines and high production costs. Therefore, intelligent manufacturing technology emerged[1].

The significance of intelligent manufacturing technology is to improve the competitiveness of the manufacturing industry. With the continuous advancement of science and technology and the constant changes in the market, traditional manufacturing is facing increasing pressure. The introduction of intelligent manufacturing technology can enable traditional manufacturing to achieve digitization and automation, improve production efficiency and quality, and reduce production costs and resource consumption. At the same time, intelligent manufacturing technology can also achieve production flexibility and personalization, adapt to market changes, and enhance enterprise competitiveness.

In summary, the background and significance of intelligent manufacturing technology are evident. The introduction of intelligent manufacturing technology can enable manufacturing to achieve digitization, automation, flexibility, and personalization, improve production efficiency, quality, and competitiveness, and bring more social benefits.
1.2 The concept and development process of intelligent mechanical manufacturing technology.

Intelligent mechanical manufacturing technology refers to the upgraded and improved traditional mechanical manufacturing technology using intelligent technology to achieve digitalization, intelligence, and automation in production. Intelligent mechanical manufacturing technology can improve production efficiency, reduce production costs, and improve product quality and machining accuracy. The development of intelligent mechanical manufacturing technology can be traced back to the 1980s when the development of numerical control and computer technology led to the emergence of intelligent mechanical manufacturing technology. With the continuous development of information technology, sensing technology, control technology, and artificial intelligence technology, intelligent mechanical manufacturing technology has been continuously upgraded and improved. Nowadays, intelligent mechanical manufacturing technology has become an essential part of intelligent manufacturing technology. The development of intelligent mechanical manufacturing technology is of great significance to the future of the manufacturing industry. Intelligent mechanical manufacturing technology can effectively improve the automation level, digital level, and intelligence level of the manufacturing industry, enhancing the competitiveness of enterprises. Intelligent mechanical manufacturing technology can also promote the development of the manufacturing industry towards high-end, intelligent, green, and sustainable development, promoting the sustainable development of the manufacturing industry.

2. The key technologies of intelligent machinery manufacturing technology.

Intelligent machinery manufacturing technology involves various technical fields, and the key technologies include but are not limited to the following. Artificial intelligence technology: including machine learning, deep learning, natural language processing, etc., can be used in production planning, process control, product design, etc. Machine vision technology: including image recognition, 3D imaging, etc., can be used in parts inspection, quality control, robot control, etc. Sensor technology: including temperature sensors, pressure sensors, vibration sensors, etc., can be used to monitor parameter changes during production and achieve intelligent monitoring and control. Cloud computing technology: can be used to achieve big data analysis, collaborative design, intelligent manufacturing, etc. Human-computer interaction technology: including speech recognition, gesture recognition, etc., can achieve human-computer interaction and improve production efficiency and quality. 3D printing technology: can achieve rapid prototyping, small batch production, customized production, etc. Network security technology: can ensure information security and network security during the production process[2].

3. The applications of intelligent machinery manufacturing technology.

3.1 Automobile production

The intelligent mechanical manufacturing technology can be applied to the intelligent upgrading of the entire automobile production line, including automation, intelligent logistics, intelligent quality control, and other aspects. This can improve the production efficiency and quality of automobiles and reduce production costs. Intelligent mechanical manufacturing technology can also be applied to the production and processing of automobile parts, such as engine components and body parts, to improve processing accuracy and production efficiency and achieve personalized customization of parts. The automation and intelligence of automobile body painting can also be realized through the application of intelligent mechanical manufacturing technology. For example, using robots for spraying operations can improve the efficiency and quality of painting while reducing painting costs. The intelligent mechanical manufacturing technology can be applied to the production and manufacturing of automobile intelligent driving systems, such as the manufacturing of sensors and control modules, to improve the reliability and safety of the driving system. In general, the application of intelligent mechanical manufacturing technology in automobile manufacturing can improve the production efficiency and quality of automobiles, reduce production costs, and achieve personalized customization of automobiles. With the continuous innovation and development of intelligent mechanical manufacturing technology, its application in automobile manufacturing will become increasingly widespread[3].

3.2 Aircraft production

The intelligent mechanical manufacturing process can achieve intelligent upgrading of the entire aircraft production line, including automation, intelligent logistics, and intelligent quality control on the production line. This can improve the efficiency and quality of aircraft production, and reduce production costs. The intelligent mechanical manufacturing process can be applied to the production and processing of aircraft components, such as engine components, body parts, etc., which can improve processing accuracy and production efficiency, and achieve personalized customization of parts. The intelligent mechanical manufacturing process can be applied to the automation and intelligence of aircraft body painting, for example, using robots for spraying operations, which can improve the efficiency and quality of painting and reduce the cost of painting. The intelligent mechanical manufacturing process can be applied to the production and manufacturing of aircraft intelligent driving systems, such as the manufacturing of sensors and control modules, which can improve the reliability and safety of the driving system. Overall, the application of
Intelligent mechanical manufacturing processes in aircraft manufacturing can improve the efficiency and quality of aircraft production, reduce production costs, and achieve personalized customization of aircraft[4]. With the continuous innovation and development of intelligent mechanical manufacturing technology, its application in aircraft manufacturing will become more and more widespread.

3.3 Other industries
Intelligent mechanical manufacturing technology can not only be applied to the automotive and aviation industries, but can also achieve intelligent manufacturing in other industries. In the electronics industry, intelligent mechanical manufacturing technology can be applied to the manufacturing of printed circuit boards, for example, using precision processing equipment to achieve high-precision printing. In the medical industry, intelligent mechanical manufacturing technology can be applied to the manufacturing of medical equipment, such as surgical robots and artificial hearts, which can improve surgical accuracy and safety. In the food industry, intelligent mechanical manufacturing technology can be applied to the automation and intelligence of food production lines, for example, using robots for food processing and packaging, which can improve production efficiency and quality, and reduce production costs. In the construction industry, intelligent mechanical manufacturing technology can be applied to the production and processing of building materials, such as the manufacturing of prefabricated concrete components, which can improve construction efficiency and quality. Overall, the application of intelligent mechanical manufacturing technology in various industries can achieve automation, intelligence, high efficiency, and personalization, improve production efficiency and quality, reduce production costs, and promote various industries towards intelligent manufacturing.

4. The advantages and challenges of intelligent mechanical manufacturing technology.

4.1 Advantages of intelligent mechanical manufacturing technology
(1) Improved production efficiency: Intelligent mechanical manufacturing technology can achieve digitalization, intelligence, and automation in production, greatly improving production efficiency. Digital processing technology can achieve digital, flexible, and high-precision processing of the production process, reducing production time and cost.
(2) Improved product quality: Intelligent mechanical manufacturing technology can achieve high-precision and high-quality production. Digital processing technology can improve machining accuracy and product quality. Intelligent detection technology can achieve automatic detection and quality control, ensuring product quality.
(3) Energy conservation and emissions reduction: Intelligent mechanical manufacturing technology can reduce manual operation, energy consumption, and emissions. Digital processing technology can optimize machining paths and reduce material waste. Intelligent detection technology can improve the accuracy and efficiency of quality inspection, reducing waste rates.
(4) Reduced production costs: Intelligent mechanical manufacturing technology can achieve automated production and digital processing, reducing labor and material costs. Intelligent detection technology can reduce waste and rework rates, reducing production costs.
(5) Enhanced production flexibility: Intelligent mechanical manufacturing technology can achieve digitalization, intelligence, and automation in production, improving production flexibility and adaptability. Digital processing technology can achieve flexible processing, adapting to production of different products and specifications.

In summary, intelligent mechanical manufacturing technology has significant advantages. It can improve production efficiency and product quality, reduce production costs, reduce energy consumption and emissions, enhance production flexibility and adaptability, and promote the development of the manufacturing industry towards high-end, intelligent, green, and sustainable development.

4.2 Challenges of intelligent machinery manufacturing technology.
With the development of intelligent machinery manufacturing technology, although it has brought many advantages, it also faces some challenges.
(1) High technical difficulty: Intelligent machinery manufacturing technology requires the application of multiple high-tech technologies, including artificial intelligence, machine vision, sensor technology, etc. The technical difficulty is relatively high. Continuous research and development and technical breakthroughs are needed to meet the needs of different industries and fields.
(2) Talent shortage: The intelligent machinery manufacturing industry requires a variety of technical talents, including mechanical engineers, electronic engineers, computer engineers, data analysts, etc. At present, there is a certain gap between talent supply and market demand, leading to talent shortage.
(3) High safety risks: Intelligent machinery manufacturing processes require digital and automated production, involving multiple risks such as personnel safety and data security. It is necessary to strengthen security precautions and measures to ensure production safety and data security.
(4) High maintenance cost: Intelligent machinery manufacturing technology requires maintenance of high-end equipment, software systems, etc., which incurs high maintenance costs. Especially in the process of use, malfunctions and damages may occur, requiring timely maintenance and repair, increasing costs and difficulty.
(5) Difficulty in integrating the industry chain: Intelligent machinery manufacturing technology
requires the integration of multiple technologies and industrial chains, including hardware, software, materials, etc. This requires companies to play a synergistic effect in the industrial chain, improve the efficiency and competitiveness of the entire industrial chain.

In summary, although intelligent machinery manufacturing technology has brought many advantages, it still faces challenges such as high technical difficulty, talent shortage, high safety risks, high maintenance costs, and difficulty in integrating the industry chain. In the future, continuous research and development and technical breakthroughs are needed, talent cultivation and introduction need to be strengthened, security management and maintenance need to be strengthened, and industrial chain integration and innovation need to be promoted to achieve the sustainable development of intelligent machinery manufacturing technology.

5. Conclusion

Currently, intelligent machinery manufacturing technology has been widely applied in many fields, such as automotive, machine tools, robots, and so on. Its advantages lie in improving production efficiency and quality, reducing production costs, and customizing production according to different needs. At the same time, with the continuous development and innovation of technology, intelligent machinery manufacturing technology will continue to develop towards intelligent, digital, flexible, and sustainable directions. Specifically, in the future, intelligent machinery manufacturing technology will pay more attention to the intelligence and automation of production. Through technologies such as big data and cloud computing, intelligent monitoring and control of the production process will be achieved. Meanwhile, flexible production will become a trend, making production more adaptable to market demands. Additionally, intelligent machinery manufacturing technology will make greater progress in the direction of sustainable development, such as green manufacturing and resource conservation, to achieve sustainable development goals. In summary, intelligent machinery manufacturing technology will play an increasingly important role in future development.

References