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Exploring the Innovative Path of Mechanical Design, Manufacturing and Automation under the Concept of Sustainable Development

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Abstract: With the global deep understanding and practice of the concept of sustainable development, the field of mechanical design, manufacturing and automation is also facing the challenge of innovation and change. This paper aims to explore under the concept of sustainable development, mechanical design and manufacturing innovation path in the field of automation, including green design, intelligent upgrade, digital transformation, network collaboration, and modularity and standardization, etc., and put forward the corresponding innovation safeguard measures, in order to provide reference for the sustainable development of the field.

Keywords: Sustainable development; Mechanical design and manufacturing; Automation; Innovation

Introduction

The concept of sustainable development emphasizes to meet the needs of contemporary people without harming the ability of future generations to meet their needs, which is also of guiding significance in the field of mechanical design, manufacturing and automation. Traditional mechanical design and manufacturing and its automation often consume a lot of resources and produce environmental pollution in the production process, which is contrary to the concept of sustainable development. Therefore, exploring the innovation path in this field and realizing the green, intelligent and efficient production mode has become an important topic of current research.

1. The innovation path of mechanical design, manufacturing and its automation under the concept of sustainable development

1.1 Green design

Green design as the cornerstone of mechanical design and automation sustainable development, need designers from the source of the product, give full consideration to the environmental factors of the whole life cycle, the design concept not only covers the choice of raw materials, more extends to the production process, use stage and waste processing each link. By giving priority to the use of environmentally friendly materials, optimizing product structure design, and minimizing resource consumption and waste production, green design can fundamentally reduce the negative impact of products on the ecological environment, reflecting the great importance of sustainable development. At the same time, the green design should also focus on the recyclability and degradable performance of the products, and actively explore effective ways to realize the closed-loop utilization of resources, in order to minimize the function and performance of the products, and contribute to shaping a resource-saving and environment-friendly society.

1.2 Intelligent upgrade

Intelligent upgrade is the key to promote the high-quality development of mechanical design and manufacturing and its automation. With the rapid development and wide application of cutting-edge technologies such as artificial intelligence and machine learning, the intelligent control and optimization of the production process has become the trend of The Times. Intelligent upgrade can not only significantly improve production efficiency and product quality, but also achieve a win-win^[1] of economic benefits and environmental benefits by reducing human input, reducing energy consumption and pollution emissions. For example, through the deployment of intelligent sensors and control systems, enterprises can monitor the energy consumption level and emissions in the production process in real time, and conduct real-time analysis according to the massive data collected, and adjust the production parameters in time to achieve the goal of energy conservation and emission reduction.

1.3 Digital transformation

Digital transformation, as an important means to promote the innovation of mechanical design and manufacturing and automation, is

profoundly reshaping the development of the industry. By making full use of big data, cloud computing, industrial Internet and other advanced information technologies, enterprises can realize the real-time collection, transmission, analysis and processing of production data, and then provide strong support for optimizing production management and improving decision-making efficiency. On the one hand, digital transformation helps to improve the refinement level and response speed of production management, and ensure the efficient and stable operation of production process; On the other hand, the accumulation and analysis of massive data also provide enterprises with more accurate market demand prediction and customized services, enabling them to flexibly respond to market changes and meet the increasingly diversified needs of consumers. In addition, digital transformation also provides a solid foundation for the construction of an intelligent supply chain system. By breaking through the information barriers between upstream and downstream enterprises, the optimal allocation and efficient sharing of resources are realized, and the formation of coordinated development and beneficial industrial ecology is promoted.

1.4 Network collaboration

As an emerging model to promote the sustainable development of mechanical design and manufacturing and its automation, networked collaboration is attracting wide attention from the industry. Through the construction of an Internet-based collaborative platform and ecosystem, networked collaboration has broken the information barriers between enterprises, and realized the efficient sharing and optimal allocation of resources. On the one hand, enterprises can use the collaborative platform to fully exchange and share design resources, production capacity and market information, which not only improves the overall operation efficiency of the industrial chain, but also provides broad space for collaborative innovation^[2]; On the other hand, network collaboration also creates conditions for small and medium-sized enterprises to participate in market competition, enabling them to cooperate closely with large enterprises through the aggregation effect of the platform and integrate into the global industrial division of labor system. At the same time, network collaboration also helps to accelerate the promotion and application of new technologies, new processes and new materials, promote the rapid transformation and industrialization of innovation achievements, and inject a steady stream of innovation vitality into the industry.

1.5 Modularity and standardization

Modular and standardized design is mechanical design manufacturing and automation important path to promote the development of innovation, through the modular decomposition and design of complex products, enterprises can be divided into multiple relatively independent function module, not only beneficial to simplify the production process, improve the production efficiency, more can significantly reduce the cost of subsequent maintenance and upgrade. At the same time, the standardized design formulates unified technical standards and specifications to ensure the compatibility and interchangeability between different modules, and further improves the reliability and stability of products. On the basis of modularization and standardization, enterprises can flexibly adjust and combine different functional modules according to the changes of market demand, to achieve rapid customization and personalization of products, and effectively meet the increasingly diversified needs of consumers. In addition, modular and standardized design also provides possibilities for enterprises to implement advanced production modes such as lean production and flexible manufacturing, which helps to improve the efficiency of resource utilization and reduce inventory and production costs.

2. Innovative guarantee measures for mechanical design and manufacturing and its automation

2.1 Policy support and guidance

The government plays an irreplaceable key role in promoting the innovation of mechanical design and manufacturing and its automation. On the one hand, the government can formulate relevant industrial policies and development plans, clarify the development direction and goals of the industry, guide enterprises to increase investment in research and development, and promote the breakthrough of key technologies and industrial transformation and upgrading^[3]. On the other hand, the government can also provide financial subsidies and tax incentives to reduce the innovation cost and risk of enterprises and stimulate the innovation vitality of enterprises. At the same time, the government should also strengthen the supervision and evaluation of innovation activities, establish a sound intellectual property protection system, create a good environment for innovation, and ensure the compliance and sustainability of innovation activities.

2.2 Talent training and introduction

High-quality innovative talents are the core elements to promote the development of mechanical design and manufacturing and its automation innovation. In order to realize sustainable development, enterprises must attach great importance to the construction of talent team, and focus on cultivating and introducing a group of compound talents with innovative spirit and master the core technology. On the one hand, the enterprise should take the initiative to strengthen the cooperation with universities and research institutes, actively participate in the talent training process, and promote the close connection with the practical ability and innovation quality of talents. On the other hand, the enterprise should also establish a sound talent introduction and incentive mechanism, adopt favorable salary and treatment and good career development

space to attract and retain foreign talents to inject fresh blood into the enterprise development. At the same time, enterprises should also pay attention to creating a corporate culture that encourages innovation and tolerates failure, stimulate the enthusiasm and potential of employees, and internalize the spirit of innovation into the pursuit of core values of the enterprise.

2.3 Strengthen international cooperation and exchanges

Strengthening international cooperation and exchange is an important way to promote the innovation of mechanical design and manufacturing and automation, which can help enterprises timely understand and master international advanced technology and management experience, improve their own innovation ability and competitiveness. Through various forms of cooperation and exchanges with international well-known enterprises and scientific research institutions, such as joint research and development, technology transfer, talent exchange, etc., enterprises can effectively narrow the gap with the international advanced level and accelerate the pace of independent innovation. At the same time, active participation in the formulation of international standards and rules is conducive to enterprises to better integrate into the global industrial chain and obtain greater market space and development opportunities. In addition, strengthening international cooperation and exchanges will also help to build a global innovation network, realize complementary advantages and resource sharing, and provide strong support for the sustainable development of the industry.^[4] In the face of the increasingly fierce international competition, the mechanical design, manufacturing and automation industry can only win a place on the world stage and achieve greater development.

3. Conclusion

Under the concept of sustainable development, the innovation in the field of mechanical design, manufacturing and automation is the key to achieve green, intelligent and efficient production. Through the exploration and practice of innovative paths such as green design, intelligent upgrading, digital transformation, network collaboration, and modularization and standardization, the development of this field can be promoted to a more sustainable direction. At the same time, the government, enterprises and all sectors of society should also make joint efforts to provide strong guarantee and support for innovation in this field. Only in this way can we take a solid step on the road of global sustainable development.

References

- [1] Luo Yujiang, Rao Yingming, Wu Kangping, Luo Zhenfeng, Li Yang. The dilemma and outlet of mechanical design and manufacturing and its automation [J]. *Mold manufacturing*, 2024, 24 (02): 62-64.
- [2] MAO Hongju, Han Feifei. An effective way to improve the level of mechanical design and automation [J]. *Foshan Ceramics*, 2023, 33 (03): 49-51.
- [3] Wang Lixia, Tang Yiling. Research on mechanical design and Manufacturing and its automation technology in the era of intelligent manufacturing [J]. *Equipment Engineering of China*, 2023, (04): 33-35.
- [4] Yu LAN. Research on mechanical design and automation [J]. *Internal combustion engine and accessories*, 2022, (05): 199-201.