

# Mechanical Design and Manufacturing and its Automation Development Strategy Based on the Concept of Green Manufacturing

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**Abstract:** Under the background of increasing global environmental pressure, mechanical design and manufacturing and its automation industry are faced with major challenges of energy conservation, emission reduction and efficient utilization of resources. Although the concept of green design is gradually popularized, it still faces problems such as technical bottlenecks and imperfect system in the implementation process. This paper proposes to strengthen the theoretical research of green design, promote the innovation of green manufacturing process, build green supply chain management system and cultivate green manufacturing talents, aiming at technological innovation and management system optimization, and realize the green transformation of the whole process of mechanical design and manufacturing.

**Keywords:** Green manufacturing; Mechanical design and manufacturing; Automation; Intelligent

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## Introduction

With the rapid advancement of industrialization, the mechanical design and manufacturing industry and its automation industry are also facing severe environmental pressure in promoting economic development. The industry is undergoing a profound shift from traditional manufacturing to green manufacturing. The market scale continues to expand, and the technology level has been significantly improved, but the problems of resource consumption and environmental pollution have become increasingly prominent. In order to achieve sustainable development, the industry needs to introduce the concept of green manufacturing, technological innovation and management optimization, reduce energy consumption, reduce emissions, and improve the resource utilization rate. It is of great significance to the transformation and upgrading of the machinery design and manufacturing and its automation development strategies based on the concept of green manufacturing.

## 1. Overview of the green manufacturing concept

The concept of green manufacturing is a modern manufacturing model that comprehensively considers the environmental impact and resource consumption. It emphasizes that on the premise of meeting the requirements of product function, quality and cost, the system considers the negative impact on the environment in the whole life cycle of products from design, manufacturing, packaging, transportation, use and scrap treatment, and maximizes the resource utilization. Green manufacturing pursues economic benefits, but also pays attention to ecological benefits and social benefits, aiming to achieve sustainable development. This concept embodies the concept of harmonious coexistence between man and nature, and is an important direction for the transformation and upgrading of the manufacturing industry in the new era.

## 2. Analysis on the development of mechanical design and automation based on the concept of green manufacturing

### 2.1 Promotion of environmental awareness and policy support

In recent years, with the increasingly severe global environmental problems, the Chinese government has attached great importance to green manufacturing, and issued a series of policy documents, such as "Made in China 2025", which clearly put forward the development goals and requirements of green manufacturing. These policies have provided an institutional guarantee for green manufacturing, stimulated the environmental awareness of enterprises and all sectors of society, and promoted the concept of green design, green manufacturing and green consumption.

### 2.2 Wide application of green design technology

In the field of mechanical design and manufacturing, green design has become an important development direction. Designers fully consider environmental factors in product design, such as choosing renewable and recyclable materials, and adopting lightweight design ideas to

reduce product energy consumption and emissions<sup>[1]</sup>. The development of digital and intelligent technology makes the design model construction more accurate and the design process more efficient, which further promotes the application of green design concept in mechanical design and manufacturing.

### **2.3 Innovation and development of green manufacturing process**

The development of green manufacturing process is the key to realize green manufacturing. Machinery manufacturing industry is actively exploring and applying a variety of green manufacturing processes, such as less cutting technology, high-speed processing technology, new cutting tool technology, etc., in order to reduce energy consumption and material consumption, reduce waste generation and emissions. The application of cleaner production technology and resource recycling technology has also greatly improved the production efficiency and resource utilization rate.

### **2.4 Enhancement of green supply chain management**

Establish a green supply chain, comprehensively consider the energy conservation and environmental protection factors in product design, procurement, production, packaging, logistics, sales, service, recycling and reuse, and jointly practice social responsibilities such as environmental protection, energy conservation and emission reduction. This management mode can help to improve the green level of the entire supply chain and promote the sustainable development of the entire industry.

## **3. Research on mechanical design and manufacturing and its automation development strategy based on the concept of green manufacturing**

### **3.1 Strengthen the theoretical research and practical application of green design**

Green design is related to the appearance and function of the product, and goes deeper into every link of its whole life cycle, including raw material selection, production process, use performance and waste disposal, etc<sup>[2]</sup>. In the process of research, we should draw lessons from the international advanced experience, and explore the reality of China's manufacturing industry based on the actual situation of China's manufacturing industry. Universities and enterprises should establish a close industry-university-research cooperation mechanism, jointly carry out green design projects, and transform the theoretical research results into practical productive forces. For example, green design courses and special seminars can be offered to improve the green quality of designers; encourage enterprises to introduce green design concept, adopt environmentally friendly materials, optimize product structure, and improve energy efficiency ratio to reduce the environmental load of products from the source. Using digital and intelligent technologies to assist green design, such as simulation to predict the environmental impact of products in different use scenarios, provides a scientific basis for the optimization of the design scheme, and is also an effective way to improve the application effect of green design practice.

### **3.2 Promote the technological innovation of green manufacturing process**

As the mainstream trend of the future industrial development, the technological innovation of green manufacturing process is related to the economic benefits of enterprises, and more directly affects the sustainable development of the social environment. The technological innovation of green manufacturing process needs to rely on multidisciplinary interdisciplinary integration, such as material science, mechanical engineering, environmental science, etc., to jointly explore new manufacturing processes and processes. This requires that in the research process, we should not only pay attention to the advanced technology, but also consider its feasibility and economy in the actual production<sup>[3]</sup>. Strengthening international exchanges and cooperation and drawing lessons from the global achievements of green manufacturing technology are also an important way to enhance China's green manufacturing process innovation capacity. Universities and enterprises should work hand in hand to jointly promote the technological innovation of green manufacturing process. On the one hand, universities can leverage their scientific research advantages to tackle key technical problems in green manufacturing, such as developing efficient and low-energy consumption processing equipment and optimizing production process; on the other hand, enterprises can transform these scientific research achievements into actual productivity, technical transformation and upgrading to improve production efficiency and resource utilization. The establishment of the energy efficiency evaluation system of the green manufacturing process and the regular evaluation and optimization of the energy efficiency of the production process are also the key links to ensure the continuous innovation and continuous progress of the green manufacturing process. These specific practices can effectively promote the technological innovation of green manufacturing process and lay a solid foundation for the realization of green manufacturing goals.

### **3.3 Cultivate green manufacturing talents and enhance public environmental awareness**

As the main force of future industrial development, college students play an important role in the cultivation of green manufacturing talents and the promotion of public environmental awareness. Green manufacturing talents need to have solid professional knowledge and skills, but also need to have a strong environmental awareness and innovative thinking. It can integrate green concepts in product design, manu-

facturing process, supply chain management and other aspects, and promote the research and development and application of green manufacturing technology<sup>[5]</sup>. The promotion of public environmental awareness is also an important driving force for the development of green manufacturing. Strengthen green manufacturing education: Colleges and universities should offer green manufacturing related courses and professional directions, and integrate the concept of environmental protection into the teaching content. Case teaching, practical operation and other ways to cultivate students' green literacy and innovation ability. Strengthen cooperation and communication with enterprises, provide students with internship and training opportunities, and help them understand the practical application and development trend of green manufacturing. Holding green manufacturing competition and exhibition: holding green manufacturing design competition, technology innovation competition and other activities to stimulate students' innovation enthusiasm and practical ability. At the same time, the green manufacturing achievements exhibition and exchange meeting will be held to show the latest achievements and application cases of green manufacturing technology, so as to improve the understanding and support of all sectors of society on green manufacturing.

#### 4. Tag

With the in-depth discussion of the development strategy of mechanical design and manufacturing and its automation based on the concept of green manufacturing, we firmly believe that this concept will become the mainstream trend of the industry development in the future. Continuous technical innovation and management optimization, we look forward to see a more environmentally friendly, efficient and sustainable manufacturing mode is widely used in the industry. In the future, the mechanical design and manufacturing industry and its automation industry will pay attention to the function and quality of products, and will be committed to realizing the harmonious coexistence of the optimal allocation of resources and the environment.

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