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# Application of Industrial Robots on Automated Production Lines in Machine Manufacturing

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**Abstract:** With the development of industrial robot technology, production has been automated, mechanized and intelligentized. This research can not only improve production conditions and labor efficiency, but also promote the smooth development of the production and manufacturing industry, thus promoting the improvement of China's overall production capacity and raising the level of production. The article first provides an overview of industrial robots, followed by a detailed discussion of the characteristics and development trend of industrial robots, and finally discusses the specific application of industrial robots in manufacturing automation production lines for further research and promotion in the future.

**Keywords:** Industrial Robotics; Machinery Manufacturing; Automated Production Lines; Stamp Processing

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## Introduction

An industrial robot is a machine that can utilize multiple robotic arms to perform operations in an orderly and regular manner. In this paper, the application case of industrial robots in seal automation production line is studied, and it is concluded that industrial robots are able to replace manual labor to complete certain repetitive labor work, so as to alleviate the shortage of human resources in the enterprise, optimize the working environment, and to improve the efficiency of production and improve the quality of products. The method has certain reference significance for the application and promotion of industrial robots in other occasions.

## 1. Overview of industrial robots

### 1.1 The status of industrial robots

Industrial robot is a set of mechanical, electronic, control, detection, computer, communications, sensors and other electromechanical integration of products, involving complex subject knowledge. When operating, different kinds of industrial robots need to be selected for different occasions of use. According to the relevant domestic data, from 2022, industrial robots have become the most used in the robot family and occupy more than half of the market share. And among them, service robots accounted for 37%, and specialty robots accounted for 13%.

### 1.2 Classification of industrial robots

Industrial robots mainly have function, use, purpose, usage, scale, structure, coordinates, drive and other modes. At present, industrial robots have developed into intelligent robots with logical thinking, judgment, decision-making and control capabilities, capable of independently completing complex work as well as autonomous learning capabilities.

## 2. Characteristics and development trend of industrial robots

### 2.1 Characteristics of industrial robots

Industrial robots have the following basic features: first, anthropomorphism. The construction of industrial robots is similar to a human arm and a biosensor. The second is versatility. Industrial robots are able to complete specific jobs autonomously in accordance with the pre-set processing sequence, with strong adaptive ability. Third, independence. Industrial robots can independently and flexibly adapt to various working environments. The fourth is intelligence. Industrial robots have the ability of autonomous perception, understanding and memory, visual cognition, argumentation and judgment, and are able to track the quality of the product, provide instant data back to them, and make adjustments instantly. The fifth is programmable. A flexible manufacturing system (FMS) is a programmable system that can be dynamically adapted to the work environment.

### 2.2 Development trend of industrial robots

China has been vigorously promoting the development of the robot industry in recent years. The Implementation Plan for "Robot +" Ap-

publication Action was released in January 2023, focusing mainly on product innovation, scene expansion and classification guidance, and further expanding the depth and breadth of robot applications in these areas. First, in terms of its scope of use, industrial robots are increasingly replacing manual operations. Second, in terms of the robot industry, the current industrial robot industry has become increasingly mature. In the upstream of industrial robots, there are component traction industries of reducers, servos, and controllers. There are body design and manufacturing traction in the midstream and industrial robot system integration enterprises in the downstream. The industry architecture of industrial robots is being further optimized, the functions of products are being improved, and the localization rate and market share are also increasing. Finally, from the development direction, the focus is on expanding the depth and orientation of the robot application field, in which the motion control technology and control system technology promote the performance improvement of the products, while the artificial intelligence-related technology promotes the enhancement of the level of intelligence, and the industrial robots are developing in the direction of intelligence, imitation biochemistry, refinement, flexibilization, standardization, and platformization.

### **3. The application of industrial robots in the automated production line of machinery manufacturing**

In the manufacturing industry, the application range of industrial robots with the main mode of loading and unloading, handling and assembly is expanding. Industrial robots and other equipment such as CNC machine tools together constitute a flexible automatic assembly line, by industrial robots for parts loading and unloading, cleaning and assembly, realized by the traditional manual work to the intelligent process, greatly enhancing the performance of the robot and the value of the actual application. Below, the article takes the machining process as a case study.

#### **3.1 The overall layout of the seal automation production line program**

In the composition system of the seal automatic processing production line, the equipment includes CNC lathe, CNC machining center, cleaning and drying system, laser marking machine, six-joint robot with his rail, six-joint robot with fixed position, three-dimensional bearings, two parts transfer workbench, one assembly workbench, one conveyor, and one AGV trolley. At the end of the manipulator, a set of automatic clamping components is installed according to the shape and size of the parts to be clamped. Commonly used layout modes are L-type, U-type, face-to-face linear, etc.. The seal production line as a whole adopts a U-shaped layout, with a three-way support and a conveyor belt on the left and right sides of the machine respectively. The system adopts a track parallel to the CNC machine tool machining center, while the assembly robot is set in the middle of the conveyor belt, which can maximize the workspace.

#### **3.2 Arrangement of workflow of seal automation production line**

In the seal automation production line, industrial robots, CNC lathes, CNC machining centers, ultrasonic cleaning machines, laser marking machines, visual inspection systems, intelligent storage systems, industrial Internet systems, AGV transporters, conveyors, floor guides, and other systems work independently of each other, each with its own functions, and cooperate with each other. They are organized and standardized, and can smoothly realize from loading and unloading to automatic conveying and positioning, so that the material can be smoothly transferred between multiple processes, safe and efficient loading and automatic conveying. The following is the workflow of the automated production line for seals:

First, the staff sorts the part blanks into categories and puts them in the designated places in the three-dimensional warehouse. Second, orders are placed with the MES for the automated production line system for the stamps. Third, the use of Automated Guided Vehicle on the three-dimensional warehouse sorting seal handle blanks for classification, and through the industrial robot will be sent to the first work platform, followed by the industrial robot to the seal blanks loaded into the three-jaw chuck of the CNC machine tool, then you can carry out the processing of the seal handle. When the CNC lathe finishes the seal handle, the industrial robot takes the seal handle off the CNC lathe and puts it on the first workbench. the AGV carriage transfers the seal handle to the ultrasonic cleaning machine for cleaning. In machining, the robot and the CNC machine tool is a kind of active and passive relationship, the robot is mainly responsible for giving instructions to the CNC lathe and transmitting the work order, while the CNC lathe is responsible for the control of the hydraulic disk of the CNC machine tool. Fourth, the AVG car completes the separation of the stamp head blank from the space bearing and sends it to the second working platform, where the industrial robot puts the stamp head blank into the CNC machining center. After the CNC machining center finishes the seal head, the seal end is removed from the CNC machine tool and put on the second working platform. The stamp handle is conveyed to the ultrasonic cleaning machine by AGV cart for cleaning. Fifthly, after the parts are cleaned, the seal handle and seal end will be conveyed to the conveyor belt, and through the visualized inspection system, the seal head will be conveyed to the laser system, and then marking will be done on it, the marking pattern and text will be designed according to the need, which is versatile, and can meet the needs of different customers. Sixthly, the seal handle and seal cover are assembled on the AGV cart, and the positioning of the parts is completed by the AGV cart. Seventh, the AGV

vehicle transports the finished seal to the designated location of the three-dimensional storage, and finally arrives at the unmanned storage.

#### 4. Conclusion

To summarize, in recent years, due to the rapid development of the manufacturing industry, the manufacturing industry has entered a completely new period of development. As a typical electromechanical device, industrial robot has become an indispensable equipment in modern manufacturing, and its application range is very wide. In the field of automated production lines, intelligent manufacturing workshops, digital factories and other fields, industrial robots are the key equipment for realizing automated production, which has a very important role in promoting China's industrial transformation and the innovation and development of modern enterprises.

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