

The Development Status and Prospect of Industrial Robots in China

Min Tan, Xiaoli Chen*

Chongqing Aerospace Polytechnic, Chongqing, 400021, China

*Corresponding Author

Keywords: Industrial Robot, Sales Volume, Industrial Development, Prospect

Abstract: Industrial Robot Industry is an Outstanding Representative of Modern Emerging Industries, a Concentrated Embodiment of Advanced Productivity, and a New Engine for China to Enter the New Normal of Economy and Pull Down the Dynamic Economy. This Paper Summarizes the Technological Development Process of Industrial Robots, Summarizes and Investigates the Current Situation of Industrial Sales At Home and Abroad in Recent Years, Emphatically Introduces the Gratifying Situation of the Increasing Proportion of Robot Sales in the Global Sales Volume in China, Looks Forward to the Future Development, Summarizes the Problems in Technical Support, Industrial Development and Other Aspects of Our Products, and Combines the Situation, Policies and Production and Research Environment At Home and Abroad in the New Era a Number of Suggestions Were Made.

1. Introduction

Industrial Robot Industry is an Outstanding Representative of Modern Emerging Industries, and a Sunrise Industry That is Constantly Innovating by Exploring New Demands. the International Organization for Standardization Has Made Clear the Definition of Robot: Robot is a Programmable Operator with Certain Programming Ability, Using Programmed to Control All Cooperative Devices, Performing Specified Tasks and Controllable Position. Industrial Robots Have 3-Axis or Multi Axis Manipulators, with High Degree of Freedom. under the Control of Program, They Can Move, Rotate, Carry and Assemble in Two-Dimensional and Three-Dimensional Space, Which is Widely Used in Industrial Automation[1]. in 1961, a Company in the United States Developed the World's First Teaching Industrial Robot, Which Has a Mechanical Arm Shape, Simple Structure and Single Controller, But It Has Opened a New Era in the Field of Robot Automatic Control. after More Than 50 Years of Development, Robot Technology is Becoming More and More Mature, Work Stability is Constantly Improving, and Intelligent Process is Gradually Improving. after Entering the 21st Century, a Large Robot Country, Represented by Japan, the United States, Germany, France and Other Developed Countries, Has Gradually Improved the Robot Industry System and Defined It as an Intelligent Tool, Which is Widely Used in the World Industrial Manufacturing Field. the Development of Industrial Robots is Constantly Optimizing the Production and Life Style of Human Beings.

2. Development History

In 1961, the United States developed the world's first industrial robot. At that time, it was applied to the automobile industry, which opened the way for the manufacturing and popularization of industrial robots. After more than half a century of practical development, industrial robots are widely used in various fields of social production, such as mechanical parts processing, automobile manufacturing, modern agricultural production, grain production, intelligent detection, artificial intelligence, power electronics, etc. In order to meet the requirements of more complex working environment and to have greater flexibility and accuracy, industrial robots have evolved from two-axis variable speed to six axis connection for decades. Volume, power output, from a huge heavyweight to precision lightweight[2]. From mechanical oil pressure mechanism to motor drive, robot technology is deepening to intelligent direction. Robots play an unparalleled role in improving

the quality of human life and liberating productivity. Different epoch-making products appear in different times, and they have epoch-making importance in the history of robot development.

3. Overview of Industrial Development

3.1 Development of Global Industrial Robot Industry

Robot is a combination of many fields of natural subjects, involving mechanical freedom, automatic control, computer programming, artificial intelligence and many other aspects. It is a complex of modern automation equipment. The industrial market divides it into three categories: industrial robot, service robot and special robot. Among them, industrial robot has the largest market share. According to the statistics of 2017 International Robot Federation, the sales volume of industrial robots reached 14.7 billion US dollars, accounting for 63.4% of the total sales volume of 23.2 billion US dollars in the world, and the sales volume of special robots and service robots were 5.6 billion US dollars and 2.9 billion US dollars respectively. At the same time, the development of the industrial chain formed by robot intelligence drives the integrated market of program design, hardware assembly, system development, etc[3]. the additional benefits brought by this will reach billions of dollars, which can reach one third of the total sales volume of robots. In the 21st century, with the rapid development of automation technology, the robot industry has taken off. In 2008, the total sales volume of robots in the world was about 113000, which entered the golden period of development after a brief stagnation in 2009. From 2009 to 2017, the annual growth rate of world robot sales has exceeded 9%, reaching 322000 in 2017. It is expected that the annual growth rate will reach 12.7% in 2018, and the total sales volume will reach 363000. Among many manufacturers of industrial robots in the world, Japan and Europe have the highest market share and the most advanced technology, realizing the independent production of upstream core components such as precision reducer, controller and servo system [4]. At the end of 1960s, Japan developed mobile phones and introduced American technology, which rapidly became a large robot production country, and now accounts for about 60% of the global market share. Europe, represented by Germany and Switzerland, accounts for 30% of the global market share. If the current world industrial robot market is classified into four echelons, there is no doubt that the first echelon is ABB company in Switzerland, KUKA company in Germany, FANUC company in Japan and Yaskawa company, followed by Panasonic company, odixi company and Kawasaki heavy industry company in Japan, and Xinsong company, which is independent in R & D and technology in China Guangzhou CNC, Guangzhou Qifan and other emerging well-known brands can be regarded as the third tier.

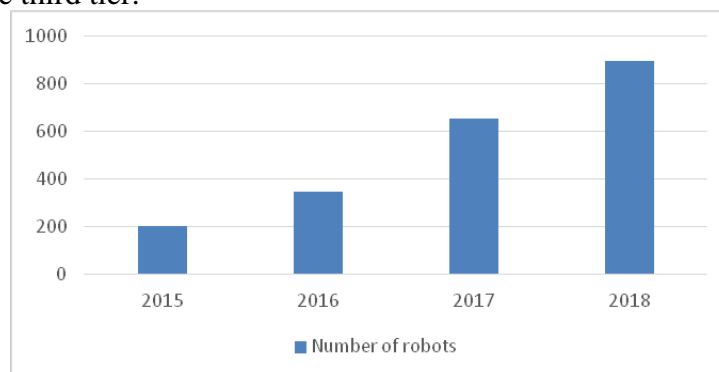


Fig.1 Number of Robots in Recent Years

3.2 Development of Industrial Robot Industry in China

China's industrial robot research started late, starting in the 1970s. The development process can be divided into four stages: theoretical research stage, prototype development stage, demonstration application stage and preliminary industrialization stage. At the beginning of the 21st century, the basic research of robots in China has made great progress and entered the initial stage of industrialization. In 2000, there were more than 200 manufacturing enterprises, including 75

industrial robot manufacturers, who independently developed and produced about 800 kinds of industrial robots, 90% of which were used in manufacturing production and mainly sold to major domestic automobile manufacturers. After nearly 20 years of struggle and development, China's robot production has been quite large-scale, the industrial chain has been gradually improved, and the road of robot industrialization is wider and wider. In 2017, as shown by the sales volume of various countries in the world, Asian countries have become the backbone of robot manufacturing in the world. The sales order of our country has reached 89000 units, far surpassing other robot manufacturing countries, even surpassing the total orders of Japan, South Korea and Germany[5]. The “one belt and one way” strategy has provided a larger platform for the development of China's manufacturing industry, and has also put forward new requirements for the level of automation equipment in China. Under the background of the new era, China's industrial robot industry continues to grow, its sales volume continues to rise, and its global market share gradually advances. Since 2013, the proportion has exceeded 20% for the first time, and reached 34.2% in 2017. With the increasing demand for domestic industrial robots and the rise of domestic brands, the market share of industrial robots in China is expected to continue to rise in the future.

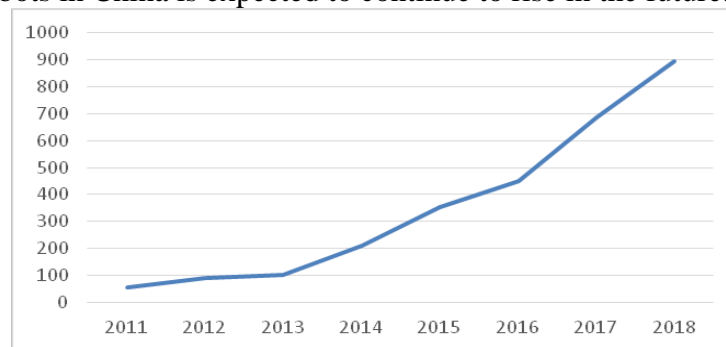


Fig.2 Growth Trend of Robots in Recent Years

3.3 Development Prospect of Industrial Robots in China

With the proposition of 2025 intelligent manufacturing in China, the development of the whole manufacturing industry has begun to change, especially the rapid development of Intelligent Manufacturing in the automobile production industry and parts manufacturing industry, with which the assembly volume of industrial robots will rise steadily. In addition, in other fields of our country, such as mining industry, water conservancy and hydropower industry, construction machinery and other industries with poor environment, it will also play a role in promoting the development of industrial robot industry. For example, most of the structural parts of construction machinery are weldments. In order to improve the quality of welding and save the time of welding, and also to meet the market demand, more and more construction machinery requires the use of robots for welding. The following is the development direction of industrial robot technology[6]. In terms of the intelligent architecture standard of industrial robots, for the research on the structure and design method of industrial robots, a set of perfect and feasible industry standards should be formed, which should be more in line with national standards and international standards, so as to promote the development speed of industrial robots rapidly, so as to facilitate the integration, application and transformation of the development prospect system of industrial robots [7]. In the aspect of new controller technology of industrial robot, the advanced industrial robot controller with independent intellectual property right is developed. In terms of intelligent operation technology of industrial robots, the development prospect of industrial robots is to realize the reliable application of intelligent technology represented by sensor fusion, virtual reality and human-computer interaction in industrial robots, so as to improve the operation ability of industrial robots. In addition to the traditional position, speed, acceleration and other sensors, assembly and welding robots also use vision, force sensors to achieve coordination and decision-making control, visual based spray robot attitude feedback control[8]; research virtual reality technology and human-computer interaction environment modeling system. In terms of complete equipment technology, China's industrial robot industry will research and develop the most advanced and efficient industrial robot application

technology in the specific industries such as automobile manufacturing industry and welding industry according to the technological requirements, combining the research of new controller technology and intelligent operation technology. A complete set of equipment design technology with industrial robot as the core is formed in the production lines of automobile production line and parts processing, which can not only improve efficiency, but also improve the accuracy of products; for the widely used arc welding robot, laser vision weld tracking device is used to integrate the spraying equipment and related functional components of the spraying line, forming a unique product with Chinese characteristics A complete set of automatic manufacturing equipment with intelligent industrial robot as the core.

3.4 Development and Research Direction of Core Parts of Industrial Robots in China

The main technology of some basic parts of Chinese industrial robots is in urgent need of improvement. At present, according to different performance, reliability and service life, domestic industrial robot parts are still in the growth stage, but there are also major imported products. There is still a big gap in foreign countries. It is necessary to comprehensively improve the quality and stability of mass production, and break the key technologies that restrict the development of Chinese robots. The main development and research directions of the main components are as follows. High precision reducer: through the development of high-strength wear-resistant material technology, process optimization technology, high-speed lubrication technology, high-precision assembly technology, reliability and life test technology, the development of high-efficiency and low adaptability of robot application, and the exploration of new transmission mechanism. Weight, long-term maintenance free series reducer. The inherent servo motor drive of high-performance robot: the optimization of high-magnetic materials, unified optimization design, assembly process optimization and other technical research, through the efficiency improvement of servo motor, reduce power loss, and achieve high power density. High speed and high performance controller: in order to improve the scalability, portability and reliability of the robot controller, please master the open controller software development platform technology. Sensor[9]: in order to meet the application requirements of robot industry, it focuses on the development of joint position, torque, vision, touch and other sensors. Terminal effect: handshake and operation function, meet the needs of the robot industry, and have terminal effects such as fast changing function grill and multi fingered dexterous hand.

4. Conclusion

To sum up, at this stage, China's demand for industrial robots is growing rapidly, and there is still a gap between the overall level of domestic robot industry and that of foreign countries. In our country's industrial robot market, there are many core technologies imported from abroad, and the industrial structure is imperfect. In order to break this situation, our country will invest a lot of money in some core parts of industrial robots We should actively explore intelligent, industrialized and standardized production, learn and introduce foreign advanced technology and experience for continuous improvement and research, and carry out development research in combination with specific reality, so as to find a path suitable for China's independent research and development, so as to form more independent brands and self owned advantages.

References

- [1] WANG Yan-wei, LI Shu-peng, KANG Shao-guo,. (2017). Analysis on development status of industrial contaminated sites remediation in china. Environmental Engineering.
- [2] Zhaoqin Peng, Guowei Ma, Jiayue Li. (2017). Human falling recognition system design with wearable pressure sensing shoes, 2017 12th IEEE Conference on Industrial Electronics and Applications (ICIEA). IEEE.
- [3] Wei Liu, Shiji Song, Cheng Wu. (2017). Single-period inventory model with discrete stochastic

demand based on prospect theory. *Journal of Industrial & Management Optimization*, vol. 8, no. 3, pp. 577-590.

[4] Jianxiao Wang, Haiwang Zhong, Ziming Ma,. (2017). Review and Prospect of Integrated Demand Response in the Multi-Energy System. *Applied Energy*, vol. 202.

[5] Hiroshige Nakamura, Tomohiro Haruki. (2018). Current Status and Future Prospect of Robot-assisted Thoracoscopic Surgery. *Kyobu geka. The Japanese journal of thoracic surgery*, vol. 71, no. 1, pp. 55-66.

[6] Shupeng Li, Yanwei Wang, Shaoguo Kang,. (2018). Ten-Year Review and Prospect of Industrial Contaminated Site Remediation in China. *Twenty Years of Research and Development on Soil Pollution and Remediation in China*.

[7] Skrynkovsky R, Pawlowski G, Sytar L. (2017). Розробка Інструментарію Для Забезпечення Якості Трудового Потенціалу Промислових Підприємств[Development of Tools for Ensuring the Quality of Labor Potential of Industrial, vol. 3, no. 9, pp. 3009-3018.

[8] Manzo K K E. (2017). Under Construction: Building on ESSA's K-12 Foundation. *Quality Counts. Education Week*, vol. 36, no. 16.

[9] Jiangming Zhang, Xifan Yao, Jiajun Zhou,. (2017). Self-Organizing Manufacturing: Current Status and Prospect for Industry 4.0. *2017 5th International Conference on Enterprise Systems (ES)*. IEEE.