The Analysis on the Development Status and Trend of Global Industrial Robots

Qian-wen LI\textsuperscript{1, a,*}, Jing-dong YAN\textsuperscript{2, b}

\textsuperscript{1, 2}School of Management, Wuhan University of Technology, China

\textsuperscript{a}42428293@qq.com, \textsuperscript{b}yjdong02@163.com

*Corresponding author

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Abstract. The development of the industrial robots is positively correlated to the national economy, science and technology. Chinese Thirteen Five-Year Guideline has included the planning about the development of industry robots. The paper summarized the trends of industrial robots’ development by analyzing the basic situation of the global development of industrial robots, which included the industrial robot industry’s model status of Japan, Europe, the United States and global industrial robotics innovation status. At the same time, the Chinese model, with Chinese national conditions, was proposed in line with the development trend of industrial robot industry.

Introduction

As same as network technology, widespread use of industrial robots is increasing, which changing people’s production and life-style. As a branch of robotics, industrial robot represents the highest achievement of mechanical and electrical integration. With the improvement of technology, the development model of industrial robots also has great significance for the rise of China’s manufacturing industry.

Applications of Industrial Robots

In 2013, the number of new robot applications in the automotive industry was about 69,200, which was 4 percent higher than in 2012, accounting for 39% market share. From 2009 to 2012, the number of automotive industry for industrial robots increased to 66500 from 19300 station station. Australia, China, India, Thailand, Taiwan and other Asia-Pacific region, the data of used in various industrial fields robots is not comprehensive. However, the application of industrial robots, as an emerging industry, in the automotive industry data may be higher due to the above-mentioned countries.

Figure 1. Global annual demand for industrial robots in different industries (unit: units)

Source: IFR, national robot associations.
At the same time, industrial robots installed capacity in the non-automotive industry continues to increase, in which there is much room for development, and the demand for industrial robots in the automotive industry still won’t be reduced due to the special nature of its industry, see Fig.1.

The amount of industrial robots in rubber and plastics industry grows in 5800 of 12,200 units from 2009 to 2013. Hence, it was still lower than the amount of the number of robots in the electronics industry reached 36,200 units in 2013, including computers, computer equipment, radios, televisions, radios, medical, precision instruments, spot industry industrial. After the amount of 37,750 units in 2011, the number of robots in the electronics industry reached a second peak, of which the market share of around 20%. In 2010, the amount of robots for industrial applications worldwide has reached 31500 units, which were 10900 units more than in 2009. After 2012, application volume declined slightly, the electronics industry, the automotive industry and new products for industrial robot applications reached a new peak in 2013.

The number of industrial robots used in rubber and plastics industry was 5,800 units in 2009, and reached to 12,200 units in 2013, which still fewer than 15,000 units in 2006 and 2007. In 2013, the industrial robot market rubber and plastics industry took 7%. The number of industrial robots used in the pharmaceutical and cosmetic manufacturing surged 69% to reach 2,000 units. The amount of industrial robots in the automotive industry was big. But the mounting robot sales in the period of time were not high. From 2010 to 2012, the sold installation of industrial robots fell from 1,500 units to 1,200 units. In the food industry (including food and drinks) increased to 6200 units compared with an increase of 28% in 2012, at the same time, 4% of the entire industrial robots occupied supply markets.

In 2013, uses of industrial robots in the metal manufacturing industry has reached a new level of 16 500 units, accounting for 9% of the total market share, in which sales fell to 5300 units had in 2009 and uses of industrial robots in the metal manufacturing industry increasing in 2012 considered to usage levels in 2011.

In addition to the automotive industry and electronics industry, the amount of industrial robots increased by 10% compared to 2013. In previous years, robot supplier grows to a certain degree, on the contrary, the sales of the industrial robots supporting facilities still very low.

The Development Trend of Global Industrial Robot Market

Industrial robots can provide stable and efficient high-quality products, especially in tact high automated production lines and harsh production environments, which efficiency advantages more than the workers. Changes in market demand for the development of the global industrial robot industry has a decisive influence:

(1) Slow population growth, increasing employment costs

Part of the population was in a slow growth phase in developed countries and developing countries, including China, the population in most developed countries showing negative growth phenomenon. Application of robots in a great extent, ease the slow population growth brought about labor shortages, high labor costs and other issues. Industrial robots can not only reduce employment costs, can increase efficiency, bring the greatest benefits for the enterprise.

(2) Improve product processing accuracy requirements

With advances in technology, precision components produced by manual turn into machine operations, such as four-axis robot welding [1], dispensing and other technical applications gradually form a chain operation. For machining high precision products mainly include electronic products, precision mechanical watches and other precision instruments.

(3) Development of equipment manufacturing industry based on high-tech

In industrialized countries, the industrial robots and automated production lines outfit has become an important part of high-end equipment and future trends. Industrial robots have been widely used
in auto and auto parts manufacturing, machining industry, electrical and electronic industries, rubber and plastics industry, food industry, logistics, manufacturing and other fields.

**Industrial Robots Industrial Development in Developed Countries**

**Industrial chain development model in Japan**

Japanese industrial robot industrial development model is the division of the industrial chain development model (see Fig.2), robot manufacturers to develop new robots and production of quality products as the main target, its subsidiaries or by integration engineering company to design and manufacture of various robotic systems industry needs.

Yaskawa Electric as the representative of Japan, with each responsible for robotics research and development, parts production, robot assembly, sales and other processes of a series of subsidiary, will market transactions into internal production enterprise groups to make production more stable, it constitutes a more mature development of the industrial chain division of formula [2].

![Figure 2. Japanese industrial robot industrial chain development model.](image)

**Industrial robot manufacturer independent development model in Europe**

European mode, the system design and manufacture of robots in the production and all the user needs to complete autonomy from the robot manufacturer (see Fig.3). Manufacturers need for system design based on the user’s needs, parts of industrial robots by the manufacturer procurement, industrial chain development model in parts production by the enterprises themselves; industrial robot manufacturer in Europe is part of an industrial robot industry chain a link to the chain of industrial robot manufacturer as the center can be simply summarized as technical resource acquisition - robots - marketing, industrial robotics innovation is the main competitive.

![Figure 3. Industrial robot manufacturer independent development model in Europe.](image)
Industrial robot manufacturer independent European development model has the advantage of manufacturers into smaller, high degree of flexibility, but subject to greater external influence, mainly in: industrial robot sales unstable, greatly influenced by the manufacturing sector; industrial robot technology requirements are relatively high.

Integration application mode in American

US Robotics development started early, of which thinking is based on the core technology related to robotics industry, and put forward relevant industrial robot development plan. June 2011 US President Barack Obama in his speech at Carnegie Mellon University, presented “NRI National Robotics Development Program (NASA, NSF, NIH)”, hopes to revitalize the US manufacturing sector. In March 2013 he proposed the “US Robotics Development Roadmap”, will focus on adaptable manufacturing capture industrial robots and reconfigurable assembly, dexterous operation, integration and supply chain design model based on autonomy key technology navigation, perception unstructured environment, education and training, robotics and intrinsic safety of people working with [3].

US integrated application mode (see Fig.4) is the combination of purchasing and package design, the United States does not produce basic ordinary industrial robots, robot enterprises need usually imported from engineering company, and then to design, manufacture supporting peripherals. European industrial robot manufacturer and the aforementioned autonomous enterprise development model is different mainly in the combination of the characteristics of the upstream manufacturers and downstream retailers: the integration of an industrial robot peripherals, but also will be required to complete a suite of application to the production of industrial robots in. The advantage is the high degree of specialization, more focused on the development of industrial robot technology and product development, manufacturing and marketing direction; drawback is that income fluctuations affect the external environment.

![Figure 4. US industrial robots integrated application mode.](image)

The Development of Industry Robots in China

The study of industrial robots in China began in the 1970s with the relatively slow development, research and application level due to the economic system and other factors. Compared with Japan, Europe, the United States, China has not yet formed scale manufacturer of industrial robots. There is still a certain gap in industrial robots technology and engineering applications between developed countries and China, which mainly reflected in:

1. the reliability and engineering applications of product is lower than foreign products; 2. the field of robotic applications is narrower, the production line system technology is still a gap compared with foreign countries; 3. lack of independent innovation make many technical aspects stay at generic level, such as the key components dependence on imports, especially the gap in the high-performance AC servo motor and high-precision reducers is particularly evident; 4. in the field of processing technology, domestic manufacturers’ heat treatment technology weaker, which directly affect the control precision industrial robots. China’s industrial robot industry is still in its infancy.
Chinese industrial robot industry is mainly distributed in the Northeast region and the Yangtze River Delta and other places. The Pearl River Delta, as one of the sources of China’s domestic manufacturing industry, provides growing soil for large-scale application of industrial robots. Northeast China, as the old industrial base, is the first area in producing industrial robots, in which there are many companies, such as Shenyang XinSong Robot Company, Harbin BoShi Automation Equipment, Haier HIT Robotics Companies and so on. Yangtze River Delta is concentrated area of China’s automobile manufacturing, electronics manufacturing and many major robotic automation companies. In addition to Shanghai international giants, such as ABB, FANUC (Fanuc), YASKAWA (Yaskawa Electric), Germany KU Juan KA (library card) companies [4], local enterprises have emerged out a lot, such as Shanghai Chevalier factory automation, Shanghai Mechatronics Engineering Center, Shanghai Grandar Partner Robot, Anhui Jianghuai automation equipment company, Anhui Ai Fute intelligent equipment company and so on. PRD industry gradually formed a labor-intensive light industry, assembly processing industry based manufacturing base after nearly 30 years of development, provided the soil for the growth of large-scale application of industrial robots. Industrial robots in China set off a boom in the use of robots, according to statistics. The annual growth rate of the Pearl River Delta region has reached 30% - 60%, especially in the assembly, dispensing, borrowed extensively welding and other industrial applications. Nowadays, Huawei, ZTE, BYD, Guangzhou Lite and other companies have industrial robots into production workshop [5,6].

The size of China’s industrial robot industry, which still in the initial stage, is small; by the impact of industrial development phase, enterprises are located in the Northeast region concentrated research and development; the growth of technology investment is increasing year after year, but the core technology is not yet industrialization; manpower replacement in great demand, broad market prospect. The development of industrial robots stays in the chapter of superposition of internal and external opportunities, in which industrial restructuring and upgrading promoting the development of equipment industry, the growth of population in favor of the release of market capacity and the active business model innovation. Meanwhile, the industrial robot industry is gradually approaching to the critical point of the rapid development of industrialization through technical accumulation and expanding the size of the initial market.

The Proper Development Model of Industry Robots in China

Combined with the development of China’s industrial robot industry, the current model of development of China’s industrial robot has the following characteristics: (1) R & D relies on universities and other research platform. China’s industrial robot technology research and development has taken the form of “product-study-research” Union that companies and universities around the CAS branch cooperation or technology research and development; (2) industry chain of industrial robot has formed partly not very whole that parts companies are independent of industrial robots Helping companies; (3) the main markets include automobile manufacturing enterprises above designated size and optoelectronics business, having broad market prospects.

Figure 5. The proper development model of industry robots in China.
As Fig. 5 mentioned, the proper development model of industry robots in China explained that “product-study-research” union got being the main strength in industrial robot R&D, different manufactures working in different parts of industrial robot production. The demands of automotive and optoelectronics industry decided the industrial robot R&D.

Summary

The development of industrial robots is on the rise. China is one of the world’s major markets of industrial robots, but has not yet become the main producing countries. Improve industrial robot technology and industrial development model is closely related to each other. To this end, our country learns from foreign advanced technology and management experience, we must also focus on improving innovation capacity of industrial robot business.

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