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Artificial Intelligent for Intelligent Manufacturing and Robotics



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Introduction

Manufacturing industry is the basic industrial sector of the national economy and one of the most fundamental factors that determine the level of development of a country. From the history of development, machinery manufacturing experienced by the hand-made, Taylor manufacturing, highly automated, flexible automation, integrated manufacturing, and intelligent manufacturing. With the development of technology, manufacturing generally follows two routes: one is the development of the traditional manufacturing technology, the second is the development of intelligent manufacturing technologies based on artificial intelligent, computers and automated science. In general, the research on intelligent manufacturing has gone through three stages. The first stage, starting from the application of artificial intelligence in the field of manufacturing in the 1980s, the concept of intelligent manufacturing was formally put forward. The second stage, the development of smart manufacturing technology and intelligent manufacturing system were proposed in the 1990s. The third stage, in the 21st century, the intelligent manufacturing could be achieved with the generation of artificial intelligent, information technology, etc. In order to seize the technological requirement of the high manufacturing industry in the world, the advanced industrial countries put forward the intelligent manufacturing system based on the study of flexible manufacturing system; computer integrated manufacturing system, factory automation and artificial intelligence, etc. For this purpose, it is necessary to carry out international manufacturing joint collaboration among universities, industries, and governments. A number of countries, including China, United States, Germany and Japan, have already proposed smart manufacturing or intelligent manufacturing related strategic policies.

Intelligent manufacturing is the information-oriented manufacturing for product life cycle and the realization of ubiquitous perception. Based on the advanced technologies of modern sensing technology, network technology, automation

technology and anthropomorphic intelligent technology, the intelligent manufacturing technology achieves the design process, manufacturing process and manufacturing equipment intelligent through intelligent perception, human-computer interaction, decision making and execution technology [1]. Therefore, the intelligent manufacturing is the deep fusion and integration of information technology and intelligent technology and equipment manufacturing process technology.

Robot is not only the key support equipment of advanced manufacturing, but also an important entry point for improving the human way of life. Whether it is an industrial robot used in the manufacturing environment or a service robot applied in non-manufacturing environment, its research and development and industrial application are important indicators to measure a country's technological innovation and manufacturing level. The development of the robot industry would be of great significance to promote industrial transformation and upgrading, accelerate the construction of manufacturing, and improve people's living standards.

The intelligent manufacturing technology is a new manufacturing concept and implementation model, whose core features emphasize the overall artificial intelligence application of the entire manufacturing system and the autonomy of the individual units. It is clear that the intelligent manufacturing system is a kind of advanced production systems to maximize productivity because of intelligence activity throughout the entire manufacturing process, organic integration between smart activities and smart machines as well as the whole manufacturing process from order, product design, production and sales integration in flexible ways. Intelligent manufacturing is characterized by three aspects: real-time perception, optimization decision-making, and dynamic execution. The intelligent manufacturing technology includes intelligent products, intelligent production and intelligent services.

Artificial intelligence research is defined as the study of intelligent agents: any device that perceives its environment and takes actions that maximize its chance of success at some goal, including reasoning, problem solving, knowledge representation, planning, learning, natural language processing, perception, motion and manipulation, social intelligence, creativity, general intelligence, etc [2].

Compared with other manufacturing systems, intelligent manufacturing system has two fundamental advantages. At first, the adoption of open system strategy achieves the shared manufacturing data and manufacturing knowledge to ensure system quality by means of information technology. It would promote the further development of manufacturing system in the direction of anthropomorphism. The second, the intelligent manufacturing system adopts the distributed multi-agent intelligent system strategy based on the idea of giving the manufacturing system components or subsystems a certain degree of autonomy in order to form closed full-function autonomy. These entities are connected to the communication network in the form of smart network nodes. In addition, the biological manufacturing and bionic mechanical science and technology, biological science and technology of forming manufacturing, green manufacturing growth including product and human and natural coordination theory, product green process also have greatly enriched the category of intelligent manufacturing, promoted the development of intelligent manufacturing system.

Researchers from Shanghai University, P. R. China have done some researches on artificial intelligence, intelligent manufacturing and robotics [3], such as the first under actuated robot wrist in the world [4], the largest 2000T offshore wind power installation platform in the world [5], the largest and quickest cold heading machine in China, the first servo cold heading machine in China, the industrial internet-based collaborative intelligent manufacturing system, the intelligent production system for gardening greenhouse in agriculture [6], the cleaner production and sustainable manufacturing for product environmental footprint [7], etc. The original under actuated robotics of Shanghai University is very worthwhile in the in-orbit assembly robotics for spacecraft paraboloid antenna and exoskeleton robotics as well.

Manufacturing industry is a pillar of national development, and the equipment manufacturing is the lifeblood of national industrial development. The overall level of equipment manufacturing determines a country's industrial development and its position and competitive power in the world. The equipment manufacturing industry not only shoulders the burden of providing advanced equipment for the reproduction and expansion of reproduction of the entire national economy, but also shoulders the task of improving and perfecting the equipment and technology of national security and national defence. The technical level of the equipment manufacturing industry is closely linked to the efficiency and quality of other manufacturing industries, and is the technical guarantee for the success of the marketing and realization of sustainable development and competitive advantages.

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