Advances in Computer, Signals and Systems (2022)
Clausius Scientific Press, Canada

DOI: 10.23977/acss.2022.060104
ISSN 2371-8838 Vol. 6 Num. 1

Discussion on the Integration of Mechatronics Engineering and Artificial Intelligence Technology

Lijing Liu

School of Engineering, Hong Kong University of Science and Technology, Hongkong999077, China

Keywords: Integration, Mechatronics engineering, Artificial intelligence technology

Abstract: with the rapid development of scientific computing, artificial intelligence technology has been widely used in mechatronics Engineering. The effective combination of mechatronics Engineering and artificial intelligence technology has promoted the development of China's economy. Therefore, this paper first expounds mechatronics Engineering and artificial intelligence technology, and then, This paper discusses the correlation and combination of mechatronics Engineering and artificial intelligence technology.

1. Introduction

Compared with traditional mechanical engineering, mechatronics engineering is the integration of artificial intelligence technology and mechanical engineering, which has the function of information connection, while traditional mechanical engineering only has the connection of energy and kinetic energy. The emergence of mechatronics engineering has brought China's science and technology into a new stage of development.

In recent years, with the rapid development of China's economy and the changing financial environment at home and abroad, the rise of human cost and the fluctuation of interest rate and exchange rate have brought great challenges to the survival and development of domestic manufacturing industry. In view of the urgent need of manufacturing enterprises to meet the needs of improving production efficiency and reducing labor costs on the premise of ensuring quality, using artificial intelligence robot products and efficient automatic assembly, transportation and other operations is undoubtedly an ideal choice for enterprises. At the same time, it is also conducive to the development of manufacturing automation and the comprehensive automation of industrial production process, The process can achieve optimal control. On the other hand, industrial robots can also replace people in industrial production to do some monotonous, frequent and repeated long-time operations and operations in dangerous and harsh environments, such as stamping, pressure casting, heat treatment, welding, coating, plastic product forming, machining and simple assembly, and in atomic energy industry and other departments, And complete the handling or process operation of materials harmful to human body.

2. Overview of Mechatronics Project

With the development of information science and technology, mechatronics engineering appears in front of people. It is mainly composed of mechanical engineering, electronic engineering, information engineering and intelligent technology[1]. In view of the development history of mechatronics Engineering, it was mainly produced by manual processing at first, but the production efficiency of this way is low, which seriously hinders the development of the mechanical industry. In order to improve the production efficiency of the mechanical industry, China continues to develop new technologies. In the second stage of the development of mechanical engineering, the production means of standard parts mainly based on assembly line production, Although such a production mode improves the productivity of the mechanical industry, the production mode has high requirements for standard parts, and the production mode can not meet the needs of social development. In order to improve the productivity of the mechanical industry, the mechatronics project has experienced the third stage, that is, the modern mechatronics project stage. The mechatronics project has strong flexibility and adaptability, Flexible manufacturing system is the product of modern mechatronics Engineering. Flexible manufacturing system can realize automatic control of material flow and information flow.

According to the characteristics of mechatronics Engineering, it is the correlation and combination of mechanical engineering and artificial intelligence technology. mechatronics engineering not only realizes the connection of energy, kinetic energy and information, but also includes intelligent computer electronic information system. Compared with traditional mechanical engineering, mechatronics engineering is very different in design and product characteristics, It includes not only mechanical engineering, but also computer technology, electronic engineering and other disciplines; The product characteristics of mechatronics engineering production, although its product structure does not adopt more components, the internal structure of the product is relatively complex with that of traditional mechanical engineering, which also leads to the phenomenon of small system of modern mechatronics engineering products, and the product performance has been significantly improved.

Mechatronics Engineering, also known as mechatronics or mechatronics, first appeared in the supplement of Japanese magazine mechanical design in 1971. With the rapid development and wide application of computer technology, mechatronics engineering technology has achieved unprecedented development. Now mechatronics engineering technology is machinery Microelectronics and information are the products of the integration and intersection of these three technologies[2].

The contents of mechatronics engineering technology include mechanical technology, computer and information technology, system technology, automatic control technology, sensor detection technology, servo drive technology, etc. Mechanical technology is the basis of mechatronics Engineering. In the manufacturing process of mechatronics engineering system, the classical mechanical theory and technology should rely on computer-aided technology, artificial intelligence and expert system to form a new generation of mechanical manufacturing technology, including information exchange, access, operation, judgment and decision-making, artificial intelligence technology, expert system technology Neural network technology belongs to computer information processing technology; Control technologies include high-precision positioning control, speed control, adaptive control, self diagnosis and correction, compensation, reproduction, retrieval, etc; Sensing detection technology is the sensing organ of the system and the key link to realize automatic control and automatic adjustment. The stronger its function, the higher the automation program of the system. Modern engineering requires that the sensor can obtain information quickly and accurately and can withstand the test of harsh environment. It is the guarantee for the mechatronics engineering system to reach a high level; Servo system is the conversion device and

component from electrical signal to mechanical action, which has a decisive impact on the dynamic performance, control quality and function of the system.

3. Overview of Artificial Intelligence Technology

Artificial intelligence technology is a comprehensive discipline, mainly including computer science, linguistics, cybernetics, etc. the development of artificial intelligence technology has experienced five stages: embryonic stage, new development stage, frustration stage, second development stage and stable development stage[3]. In the 17th century, a famous scientist invented the first mechanical addition calculator. Although artificial intelligence technology is in its infancy, it has laid the foundation for the next stage of development of artificial intelligence technology. In 1956, artificial intelligence technology entered a new stage of development. Because a scholar used the term artificial intelligence technology at the carbon talk conference, a large number of scientists studied artificial intelligence technology, that is, imitating the machinery of artificial intelligence technology through LISP language. Until the mid-1960s, that is, the setback stage of artificial intelligence technology, At this stage, scientists found it very difficult to use machines to model human logical thinking. The setback stage of artificial intelligence technology baffled a large number of scientists, but some scientists continued to explore and study it. In 1972, a famous scientist discovered a new technical language of artificial intelligence, namely Prolog language. The second development stage of artificial intelligence technology, which focuses on the integration of knowledge, that is, through the infiltration of knowledge engineering, artificial intelligence technology is applied in various fields. The progress of artificial intelligence technology has promoted the development of commercialization Road, and remarkable achievements have been made in the practical applications of intelligent robot and distributed artificial intelligence technology. With the continuous development of computer technology, artificial intelligence technology has entered a stable development stage, realizing the development of artificial intelligence technology from single subject to distributed subject. At present, artificial intelligence technology can realize the solution process of multiple objectives.

Intellectualization, i.e. holographic systematization, describes the behavior state of the machine, absorbs new discipline methods and new design ideas such as computer science, fuzzy mathematics, operations research, chaotic dynamics, artificial intelligence and physiology, so as to simulate human thinking ability and make it have the ability of thinking, consciousness and behavior like human beings, To achieve a higher level of control objectives.Artificial intelligence, also known as machine intelligence, is a new technical science that studies the theories, methods, technologies and application systems used to simulate, extend and expand human intelligence. It is also a comprehensive discipline developed by the mutual penetration of computer science, cybernetics, information theory, neurophysiology and other disciplines.

The purpose of artificial intelligence is to enable computers to command machines to think and act like human beings. It has always been a frontier discipline of computer science. In some places, computers use programming languages and other software to help people carry out work that originally only belongs to human beings. Computers have played a great role for human beings with its high speed and accuracy. Professor Winston of Massachusetts Institute of technology believes that artificial intelligence is to study how to make computers do intelligent work that only talents could do in the past, which shows that artificial intelligence is to study the laws of human intelligent activities and construct artificial systems with certain intelligence, that is, to study the basic theory of how to use computer software and hardware to simulate some human intelligent behaviors Methods and techniques.

4. Application Analysis of Integration and Combination of Mechatronics Engineering and Artificial Intelligence Technology

With the popularization of computer network technology, China has entered the information society, and the development of artificial intelligence technology is directly related to the development of the information society[4]. The effective combination of artificial intelligence technology and intelligent technology in mechatronics engineering can not only effectively process information, but also establish and control mechanical models, and carry out fault diagnosis for mechanical models, Due to the instability of mechatronics engineering itself, if the mechanical input and output information is described, the mechatronics system is difficult to describe the information. It mainly describes the information by guiding mathematical equations, building rule base and learning to generate knowledge. Although the traditional mechatronics system has strong tightness and accuracy, but, Such a mechanical and electronic system can not meet the development needs of modern society. It can only be suitable for systems with relatively little information. Artificial intelligence technology is mainly a knowledge-based information processing method, which has uncertainty and complexity in the process of processing information. Therefore, Artificial intelligence technology and information processing technology have become an effective means to analyze mathematical equations in mechatronics Engineering. The mechanical and electronic system established by artificial intelligence technology mainly includes neural network system and fuzzy reasoning system[5].The fuzzy reasoning system refers to the simulation of human logical thinking to analyze the language signals of human brain, while the neural network system mainly analyzes the digital signals given by human brain by simulating the structure of human brain, Although the neural network system and fuzzy reasoning system have similarities in information input and output processing, they also have differences. First, the neural network system is not clear in physical meaning and adopts point-to-point mapping, while the fuzzy reasoning system has clear physical meaning and adopts domain-to-domain mapping; Secondly, for the information storage of artificial intelligence technology, neural network system and fuzzy reasoning system store information in distributed and regular ways respectively; Third, in terms of information link and calculation, the link between neural network system and fuzzy reasoning system is fixed and the amount of calculation is different. The amount of calculation of neural network system is large, while that of fuzzy reasoning system is small. Therefore, the comprehensive artificial intelligence technology system plays an important role in the mechanical and electronic system.

5. Conclusion

The combination of mechatronics Engineering and artificial intelligence technology maximizes the function of mechanical and electronic system. The mechatronics engineering using artificial intelligence technology can meet the development needs of the current society. With the rapid development of computer network technology, it has not only led to great progress in science and technology, but also brought a new look to daily life. The global economy and production are connected by various networks, and the competition among enterprises will also face network globalization. Once a new product of mechatronics Engineering is developed, As long as its quality and function are reliable, it will sell well all over the world. Due to the further popularization of the network in the world, all kinds of remote control technologies related to the network will continue to develop, because the terminal equipment of remote control is mechatronics engineering products. Therefore, mechatronics engineering products will inevitably develop towards network globalization.

References

[1] Systems engineering in the design of mechatronic systems[J] . R.Rothful,M. Lasa,H.-M. Heinkel,P. Tirgari. Int. J. of Vehicle Design,2019(2)12-14.
[2] EFDEX: A Knowledge-Based Expert System for Functional Design of Engineering Systems[J] . W. Y. Zhang,S. B. Tor,G. A. Britton,Y.-M. Deng. Engineering With Computers,2018 (4)67-68.
[3] A conceptual study for a computer-based tool to support electronics design in a mechatronic environment[J] . R.M Walters,D.A Bradley,A.P Dorey. Microprocessors and Microsystems, 2020 (2)90-91.
[4] A feature-based approach towards an integrated product model including conceptual design information[J] . G. Brunetti,B. Golob. Computer-Aided Design,2018 (14) 102-103.
[5] Automatic generation of system-level dynamic equations for mechatronic systems[J] . A. Diaz-Calderon,C.J.J. Paredis,P.K. Khosla. Computer-Aided Design, 2019 (5) 56-57.