Cultivation of Innovation Ability of Mechanical Automation Design for Intelligent Manufacturing

Lei Zou*

Water Conservancy of Shandong Technician College, Zibo City, Shandong province, China

*Corresponding author e-mail: zoul_2018@163.com

Abstract. At present, the new technology represented by computer information technology promotes the rapid development of all walks of life, for the mechanical design and manufacturing field also played a huge role in promoting. Compared with the traditional mechanical design and manufacturing technology, the advantage of the new mechanical design which integrates the intelligent technology is that the resources are more intensive, the integration is higher and the environment is more intelligent. The innovation ability training of high quality human resources in mechanical specialty is the main force to promote the transformation of China from a "manufacturing power" to a "manufacturing power". Based on the speciality of mechanical design innovation ability raise as the goal, in the basis of summarizing the research on mechanical undergraduate education in our country, define the mechanical design in intelligent manufacturing innovation connotation, studies the mechanical design innovation ability training mechanism, mainly include: optimization of course structure, strengthen the engineering practice, the unity and actively participate in mechanical creative design competition. The feasibility and effectiveness of the above theory was verified by taking the mechanical innovation design of mechanical design and manufacturing and automation in the school of mechanical and electronic engineering of a certain college as an example.

Keywords: Mechanical Design, Intelligent Manufacturing, Innovation Ability, Training Mechanism

1. Introduction

With the continuous development of the information society, a series of information intelligent manufacturing technologies, automatic manufacturing technologies and intelligent manufacturing technologies have emerged. The emergence and development of these intelligent manufacturing technologies in various forms have profoundly affected people's work and life in the information age and promoted the development of China's economy and society. Industrial intelligent manufacturing concept and the development of technology is a series of high and new technology in our country's important application in the field of modern industrial production technology and, by the wide application of the intelligent manufacturing technology to effectively improve the efficiency of the
industrial production of intelligent manufacturing technology in our country, reduce the labor intensity of modern industrial production in China, to improve the performance and quality of our country's modern industrial products. The emergence and development of the manufacturing concept and technology of industrial intelligence point out a new strategic direction for the development of modern industrial intelligent manufacturing industry in China. With the deepening and development of the socialist economic globalization, the development of the concept and technology of industrial intelligent manufacturing has been widely concerned by more and more Chinese people, which plays an important role in guiding and promoting the transformation and upgrading strategy of China's industrial intelligent manufacturing industry in the information age. With the development of the concept and technology of industrial intelligent manufacturing, it is necessary to realize the development of low energy consumption, multi-function and automation. Therefore, it is necessary to combine the connotation and structure of the concept and technology of industrial intelligent manufacturing to analyze its important position and function in the field of industrial intelligent manufacturing technology in China.

PAN Yan introduced an optical-mechanical design of a spectrum-continuous radiometer for automatic observation of surface reflectance. SCR works in the range of 400-2400 nm, and can automatically measure the surface reflectance of radiating marks to obtain continuous hyperspectral reflectance data. The calibrated white diffuse reflectance plate is used as the reflectance standard, and the diffuse reflectance plate is cut into an optical measurement path by a rotatable manipulator. PAN Yan designed an air purification mechanism to keep the panels clean, which is important for the long-term applicability of SCR in the field. The static structure module of ANSYS WORKBENCH is used for the static analysis of the rotating arm, which is prone to failure. The results show that there is a certain stress concentration in the position of the rotating shaft, and the further away from the rotating shaft, the greater the deformation, and the maximum deformation can make the shaft inclination at 0.3 [1]. Practical teaching is one of the teaching contents of the talent training goal of colleges and universities. It is an important part of the teaching plan in colleges and universities and plays an important role in improving students' ability of innovation and practice. Lian Zhengguo has improved and innovated the traditional practice teaching mode of mechanical and electrical engineering college of Qingdao agricultural university. A practical teaching system is established, which emphasizes the combination of application and innovation. This paper expounds the principles of condition guarantee and management guarantee system in the innovation practice teaching system. Lian Zhengguo analyzed the effect of the new practical teaching system. The results show that the new system can effectively improve the practical application ability and innovation ability of engineering students [2]. Aiming at the innovation problem in the process of active remanufacturing design, Hong BAO USES the innovation problem solving theory (TRIZ) to put forward the green innovation design method of active manufacturing. Combined with TRIZ conflict resolution principle and environmental quality function deployment, the design of remanufactured parts is improved by using the active remanufacturing correlation table of design parameters and engineering parameters. Based on the analysis of the existing active remanufacturing design conflicts, the knowledge mapping and extraction mechanism of active manufacturing green innovative design is established. Hong BAO proposed an active remanufacturing green design conflict resolution method combining TRIZ and knowledge mapping, and evaluated the design scheme from the aspects of remanufacturing performance, life cycle energy consumption and cost. A computer aided design system was developed to improve the efficiency and success rate of green design of active remanufacturing structures. Finally, the feasibility of this method is verified by a design example of the transmission input shaft [3].

This paper analyzes the present situation of machinery manufacturing industry and discusses the characteristics and advantages of intelligent machinery manufacturing. On the basis of the application technology of intelligent machinery design, some Suggestions on how to cultivate the innovation ability of mechanical automation for intelligent manufacturing are put forward. Thus, it is concluded that intelligent design is the development direction of the machinery manufacturing industry, and its
advantages lie in the realization of resource saving, and optimize the process, improve the practicability of technology, promote the development of the industrial level. Designers should improve the use of machinery manufacturing, innovate management concepts, and put new materials into the production process, laying the foundation for the sustainable development of China's industry.

2. Proposed Method

2.1 Intelligent Manufacturing

(1) Characteristics of intelligent mechanical manufacturing

The characteristics of intelligent machinery manufacturing mainly include the following aspects: first, safety. The process of intelligent machinery manufacturing is relatively complete, and has a high rationality. It can supervise the data transmission by relying on the network carrier, and select the process method according to the type of products to realize technological innovation [4]. When the speed of mechanical manufacturing decreases, the intelligent system will carry out timely inspection and analyze the location of the components in fault to form an effective solution. Second, resources consume less energy. The intelligent mechanical manufacturing mode reduces the material consumption to a certain extent, and adjusts the operating track under the control of the transformer to reduce the friction between the devices and achieve the effect of resource saving. Third, convenience and simplicity. The manufacturing process of intelligent machinery is more simple and convenient. The staff only need to operate according to the instructions planned in the system. The intelligent driver will conduct automatic analysis, plan the production design, adjust the production efficiency, upgrade the system, etc. [5].

(2) The importance of intelligent mechanical manufacturing

The importance of intelligent mechanical manufacturing is self-evident. It not only optimizes the technological production conditions, but also makes the whole operation process more coherent, reasonable and scientific, saving manpower and optimizing the working status. First of all, the goal of intelligent mechanical manufacturing is the concept of "sustainable development". In the design process, the staff tries to choose some green materials, and changes the working state of the mechanical products themselves, thus realizing the upgrading of the manufacturing level. Secondly, the control mode is more flexible [6, 7]. The particularity of intelligent design lies in that the system can analyze the product properties on the basis of information collection, and work out an effective optimization plan, control the entire production process and supervise the manufacturing methods through data accounting [8].

(3) Discussion on mechanical design technology in the era of intelligent manufacturing

Intelligent network application is common in the process of machine manufacturing. First, it improves the traditional processing form, reduces the workload of managers, and realizes remote control. On the one hand, the application of network technology has realized the reasonable control of the production site. The intelligent design system will transfer the product utilization mode of each step to the user terminal, and the data set control center will submit the analysis results to the management staff, and make solutions to the problems easily generated. Second, the use of network technology also makes production methods more reasonable. First of all, the system can take the "economic" factor into consideration, compare the price according to the material nature, list the advantages and disadvantages of different products, score the overall design, provide good choices for decision makers, and create favorable conditions for product sales [9, 10].

3. Experiments

3.1 Experimental Background

For China's intelligent manufacturing industry, with a strong continuous innovation ability and a large number of high-quality professional human resources, it has already had the requirements and driving force for the sustainable development of the manufacturing industry. In particular, applied mechanical
professional innovative talents are one of the main innovative talents exported to the domestic intelligent manufacturing market. Under the background of the increasing number of innovative talents in China's applied machinery undergraduate universities, it is of great theoretical significance and extensive practical research value to research and develop the quality improvement and cultivation of innovative talents for applied machinery undergraduate students in the field of intelligent equipment manufacturing. As the applied mechanical undergraduate course colleges and universities in our country gradually rise in number of innovative talents, cultivating a batch of strong ability to adapt social environment and the market competition ability of high technical quality of applied mechanical undergraduates professional technology innovation has become the manufacturing industry in our country and the mechanical innovation is an important development strategy direction of undergraduate course colleges and universities.

3.2 Experimental Design

Based on the mechanical design and manufacturing and automation major of the school of mechanical and electronic engineering in the 2018 academic year, this study formulated a reasonable training program. Quality education should be advocated to train qualified talents, which should start from the aspects of knowledge structure, application ability and comprehensive quality. To achieve this, we must establish a feasible implementation model.

The cultivation of engineering talents should be oriented to engineering application and market demand. It should not only be devoted to the application of theory in theoretical teaching, but also strengthen the practice and highlight the systematic, engineering and practical education. This requires: for each teaching module, a corresponding set of practice teaching links should be established. Each set of practice links should include a complete process of connecting before class (introduction practice), during class (experiment class) and after class (course design), so as to achieve the cooperation with the corresponding theoretical teaching modules to complete the training of corresponding levels. As an important part of professional teaching personnel training, the systematic and comprehensive curriculum design of real weapon and real gun should be especially strengthened. Students must make comprehensive use of the knowledge they have learned to carry out the corresponding system design, and get comprehensive training from the curriculum design of mechanical, electrical and electromechanical control systems. The laboratory construction should follow the current situation of technology development and application through the flexible combination of simple functional modules and complex control system.

After the culture program lasted for four months, the experimental results were analyzed as shown in Table 1.

**Table 1. Analysis of evaluation results of some excellent mechanical design works**

| Project          | Design content                                                                 | Purpose of design                                                                 | Improvement under the cultivation program                        |
|------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------|
| The elevator to  | Based on the principle of elevator, a long-distance elevator between the earth  | To achieve the ground to the ground and monthly logistics and personnel flow     | Recognize the irrationality of the scheme and improve it         |
| the moon         | and the moon is designed through the centripetal force of the near-earth space station. |                                                                                  |                                                                  |
| City viaduct     | Based on the principle of air cable, the air cable is designed at each node of the city | Solve urban congestion                                                           | Recognize the irrationality of the scheme and improve it         |
by the comprehensive application of electricity and gravity

| Project                          | Design content                                                                 | Purpose of design                  | Improvement under the cultivation program |
|----------------------------------|--------------------------------------------------------------------------------|------------------------------------|-------------------------------------------|
| Stereoscopic water-saving wisdom Can device | Fully consider the different needs of urban water, water resources classification, design three-dimensional, multi-distribution, multi-channel intelligent pipeline. | Urban water conservation           | A more practical scheme was designed     |

4. Discussion

4.1 Analysis on the Cultivation of Innovation Ability of Mechanical Automation Design for Intelligent Manufacturing

A school is mainly studied in automation, mechanical design and manufacturing and application of education mode, as shown in Figure 1, in cultivating a batch of have the machinery, electronics, control and so on related discipline knowledge of basic theory of mechanical engineering and its automation and strong mechanical engineering theory based on practice and application ability of students, optimize the curriculum structure, strengthened the engineering theory to practice, pay attention to the combination of production, application, opened a mechanical innovative thinking training course theory and its application to expand innovative thinking ability training courses, further optimize the design of mechanical and manufacturing innovative thinking theory and the practice of curriculum, the modular division of labor, Actively explore and promote the design of large - scale intelligent mechanical products. At the same time, it actively explores and improves the mechanism of encouraging application-oriented undergraduates to actively participate in the design and governance practice education of mechanical innovation thinking and entrepreneurship. In addition, the college teachers of professional class should be based on the specific professional course of concrete teaching content to develop a complete set of professional course teaching implementation plan, at the same time, the school will further strengthen the the development of professional course teaching, establish a professional classroom teaching, the construction of information network platform for professional class interaction between teachers and students build a good interactive learning and information exchange of learning platform, promote the reform and development of professional class education system, for the growth of the professional class students build a good professional course learning environment education practice, promote the professional class the students' growth and progress.
4.2 Suggestions on Cultivating Innovative Ability of Mechanical Automation Design for Intelligent Manufacturing

Professional colleges and universities in the process of teaching reform, we should establish the corresponding performance appraisal way, for students, each grade should have its corresponding appraisal way, evaluation on students' knowledge, a kind of understanding, for a student for master degree of knowledge, but each course has a different way of examination and assessment of selected are determined according to the nature of the course. The examination of the course should fully reflect the students' understanding of professional knowledge. For example, mechanization course examination, should be a more flexible way of evaluation, rather than on its theory to examine the master degree of knowledge, the most main is the student in the learning process, for what has its own design, have to be combined with theoretical knowledge and practice, appraisal of students with double the score as part of the test results.

5. Conclusions

Aiming at the cultivation of innovation ability of mechanical automation design for intelligent manufacturing, this paper summarizes the reasonable Suggestions applicable to the current teaching environment after conducting a four-month training program experiment for the students of a school of mechanical automation. Ability cultivation should not be limited to the teaching of students' theoretical knowledge, but should focus on the cultivation of students' practical ability. The reform of teaching in professional colleges and universities should adapt to the current development trend of social enterprises and cultivate students according to the requirements of enterprises for talents, so that the development of students can meet the requirements of enterprises for talents.

References

[1] PAN Yan, LI Xin, ZHAI Wen-chao. Opto-mechanical Design of a Spectrally-continuous Radiometer for Surface Reflectance Automation Observation[J]. Acta Photonica Sinica, 2018,31(3):57.

[2] Lian Zhengguo, Yang Ranbing, Zhai Kun. Reform of Practical Teaching System Based on Application and Innovation Ability Training[J]. Agricultural Engineering, 2015,24(1):67-72.

[3] Hong BAO, Z. Liu, D. Hu. Research on Green Innovation Design Method of Active Manufacturing Using TRIZ[J]. Journal of Mechanical Engineering, 2016, 52(5):33-39.

[4] Dan Zhang, Bin Wei. Mechatronics and Robotics Engineering for Advanced and Intelligent Manufacturing[J]. Lecture Notes in Mechanical Engineering, 2017,12(1):45.

[5] Xu Xi. The Design and Application of Mechanical Automation Technology in Food Factory Network Management System Based on Fractional Algorithm[J]. Journal of Computational & Theoretical Nanoscience, 2015, 9(1):1092-1096.
[6] Wuxiang ZHANG. Recent development on innovation design of reconfigurable mechanisms in China[J]. Frontiers of Mechanical Engineering, 2019, 14(1):15-20.

[7] Wuxiang ZHANG, Shengnan LU, Xilun DING. Recent development on innovation design of reconfigurable mechanisms in China[J]. Frontiers of Mechanical Engineering, 2018, 14(1):78-82.

[8] Yanqiang Liu, Tianming Du, Yapeng Sun. Numerical analysis of mineral crystals on mechanical properties of mineralized collagen fibers[J]. International Journal of Applied Ceramic Technology, 2018, 15(4):277.

[9] Peter Benjamin Michael Thomas. Bespoke automation of medical workforce rostering using Google's free cloud applications[J]. Journal of Innovation in Health Informatics, 2017, 24(4):323-328.

[10] H.-C. Hsieh, Li Chien, C.-C. Lan. Mechanical design of a gravity-balancing wearable exoskeleton for the motion enhancement of human upper limb[J]. Proceedings - IEEE International Conference on Robotics and Automation, 2015, 5(12):4992-4997.