

## The Application and Reform of The Course Exercise of Mechanical Design Base on 3d Molding and Analysis Software in Colleges and Universities

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*Abstract: The course exercise of mechanical design is one of the most important training courses for the students of mechanical engineering in colleges and universities. The course design project that designs the two or three speed transmission by hand or CAD software, has been widely used in the course exercise of mechanical design and has become a very typical course of practical training. However, due to charger of the topic and contents not cater to the development of processing technology, resulting to the training course content is relatively single and relative mechanization. It can improve students' drawing ability to a certain extent. So, universities should be introduce 3D modeling, motion simulation and mechanical analysis software in the exercise course, promoting students' innovative awareness and practical working ability, enhancing the development that using computer aided design software to solve the problems of the engineering.*

*Keywords: The exercise course of mechanical design; Computer aided design; Teaching reform; Practical training.*

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### 1. INTRODUCTION

The demand of mechanical design talents who have innovative abilities are gradually increasing in the vast machinery enterprises in china. The Former Chinese Premier Wen Jiabao proposed that China should be transformed from a manufacturing powerhouse into an innovative one at the annual meeting of Davos in the summer of 2011. Undergraduates are the future of the motherland, and colleges and universities are the base of training for talents. Therefore, the orientation to the talent training plays a key role in universities, it means that what kind of person training should be cleared, what kind of skills be grasped for students, and what kind of work will be engaged upon graduation? The personnel training program should be formulated by the needs of the talents of the enterprise [1-3].

The Course Exercise of Mechanical Design is the practical curriculum of Mechanical Design, the training contents involving Theoretical Mechanics, Mechanics of Materials, Mechanical Drafting, Measurement and Common Difference, the training purpose is to cultivate students how to use the theoretical knowledge solve the engineering problem, improving their ability of mechanical design, enhancing further the understanding of theoretical knowledge [4,5]. The course exercise of mechanical design is the first training curriculum for the students with engineering background, the course's aim requires students to study the basic design method for parts, equip the skill of referring the related resources. Meanwhile, it cultivates students' ability of independent thinking and innovation.

There is a great disconnection between the course teaching method of the course exercise of mechanical design and the product development method of mechanical enterprise [6-8], at present. With the development of computer simulation technology, the 3D modeling, motion simulation and mechanical analysis software have been applied in mechanical enterprises. But the training course content still use traditional manual or CAD drawing, the product that designed by students didn't involve the feasibility analysis and machining, resulting to the talents not satisfied with the requirements of mechanical enterprises [9,10]. This article will discuss the necessity of the course reform which introducing the 3D modeling, motion simulation and mechanical analysis software in the course exercise of mechanical design, offering a reformation path of the teaching reform.

## **2. THE PRESENT STATUS AND SHORTCOMING ANALYSIS OF THE TRAINING CURRICULUM**

### **2.1 The present status analysis**

At present, the designs of transmissions, mechanical transmission components and other typical mechanical structures have been widely used in the training contents for the course exercise of mechanical design, such as multi-stage spur gear reducer, bevel gear reducer, worm reducer and so on, some colleges and universities also use the competition or graduation projects as the training course subject. The training period was arranged for 32 classroom hours, universally. The training course is offered in the summer term, which is considering the continuity of training. In our university, the course subjects are propounded by the teacher, the content of the training course is mainly design two-speed or three-speed transmission, the different of student issues is only reflected in the different parameters, while the structure and style of transmission are basically the same. The teaching method requires students to complete the design, independently, to submit the design instruction booklets and drawings in the end of training course. Finally, the student score is evaluated by the quality of the design instruction booklets and drawings. During course training, students design the drawings by hand or CAD software, this training method improve the students' drawing skills and enhance students' ability to complete the subject independently.

### **2.2 The shortcoming analysis**

Due to the lack of the training teachers, teaching facilities and avant-garde awareness of teaching reform, the subject of the course exercise of mechanical design has been unchanged, for the past many years in some colleges and universities. Moreover, the difference between student subjects is

small, students lack the freshness and easily bored, resulting to the plagiarism is that more likely to occur among students and the exactly similar designs are appeared in the student submitting products, it is difficult to achieve the desired training results. In addition, this training method tends to make students more emphasis on training drawing skills, the quality of the drawing is used for the main evaluation index to the student score. This idea exists widely in students' consciousness, which the better quality of drawing can get higher scores, but few students seriously think about the product design innovation, processing technology and tolerance.

### **3. DISCUSSING THE REFORM OF THE TRAINING CURRICULUM**

#### **3.1 Collaborative innovation**

The traditional training method is difficult to improve the student's innovation ability, and enhance the collaborative awareness, which require students to independently complete the design instruction booklets and drawings. Therefore, the reform of the traditional training course is necessary, which choose the larger and complex mechanical structure as the subject, such as the topic of the National College Mechanical Innovation Competition and Graduate Design. Forming a new training method that multiple students to complete this subject together, and each student is responsible for designing a part of the subject in the team, assembling the each part of the students' design, and obtaining a complete product that can get certain function.

This article will take the example of the fruit picking machine to illustrate the training method of The Course Exercise of Mechanical Design, the picking machine can be divided into the picking robot, moving mechanism and telescoping mechanism. Three students are divided into one group, A student is responsible for the picking robot design, which performing the function of grabbing fruit. B student designs the moving mechanism, which achieving dynamic grasping fruits. C student designs the telescoping mechanism, which picking the different height fruits. Each mechanism of the picking machine require student to seriously think and complete the design. Meanwhile, to complete the designs of the project, everyone needs to learn and supervise the designs of other students in addition to own design. The training method of integrating the designs of the different students can effectively improve students' ability of collaborative innovation.

#### **3.2 Introducing the computer aided design software**

The computer aided design software should be introduced in the training course, improving the design feasibility and strengthening students' design skills [9]. The computer aided design software mainly including the 3D modeling, motion simulation and mechanical analysis software for mechanical engineering. Students can use the 3D modeling software to create the three-dimensional digital model with any shape and geometry basing on their lesson plans, such as Solid Works, Pro/e, CATIA, UG and so on. The motion simulation software is used for confirming the reliability of the design structure and function after completing the designs, checking the design structure for interference, the movement process can be intuitively shown for students that just defining the trajectory and setting the drive parameters. This visual simulation method improves the students' design efficiency and increases the training course novelty. Especially, for the students who came into contact with the visual simulation method in first time, it creates a larger impact on their thinking. In

general, the motion simulation function come with the 3D modeling software, such as the "Motion" module of Solid Works, the " DMU " module of CATIA. In addition, the ANSYS is one of the typical mechanical analysis software, is widely used in machinery enterprises, the application of ANSYS makes the training method closer to engineering design.

### **3.3 Combining with the metalworking practice courses**

Currently, students just be required to complete the design instruction booklets and drawings for the course exercise of mechanical design, don't involve the processing, resulting to the disconnection between the drawing and processing. Wherefore, the training method as a very effective way to improve the teaching quality, which the course training should be combine with the metalworking practice courses [10].

The metalworking practice contents include the manual machining, CNC machining, laser machining, welding and 3D printing, the training purpose is to enable students understand the traditional or modern processing techniques, requiring students to study some equipment operation skills. In general, the training equipment can meet the processing requirements of the training subject in both quantity and type, therefore the design product of the training course can be used for the processing subject of metalworking practice, and students select the processing equipment to machine according to the product's technical requirements. For example, selecting the CNC lathe to machine the shaft and hole parts, during the processing, students enter the machining program into the CNC based on the part design parameters, under the guidance of the teacher. When the processing is completed, using the design drawings to verify that the processed product meets the design requirements. The benefit of this training method is that requiring students to seriously consider the equipment selection and machining accuracy when designing the processing drawings.

Combining the course exercise of mechanical design and metalworking training course, not only fulfill the requirements of metalworking training, but apply the design drawings to the machining, this training way enable students to deepen the comprehension of the theoretical design and processing technology. The students' scores are evaluated by the quality and function of the product which assembling each student's components in a group, checking whether the product meets the design requirements, analyzing the design and processing deficiencies.

## **4. CONCLUSION**

The training subject should be reformed in the course exercise of mechanical design, which unchanged for past many years. Introducing the computer aided design software is a very effective method to enhance student's design ability, and the course design is carried out in the form of group, exercising the students' abilities of the collaborative innovation. The product design method of enterprise is applied to the course exercise of mechanical design, cultivating the development that using computer aided design software to solve the problems of the engineering. The training reform of combining with the metalworking practice course can increase the connection between the courses and processing, forming an innovative comprehensive training program, improving students' interest on practical teaching, making the theoretical design apply to practical processing. The students design

drawings are used to check the quality and functions of their own processed products whether meet the design requirements, in the end of training course.

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