Design and Practice on Curriculum Ideological and Political Education in Automobile CAD/CAM/CAE Course

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Abstract. The curriculum ideological and political education is the foundation of education. The university teachers should keep up with the pace of development and do a good job in designing curriculum ideological and political education. According to the teaching characteristics, the ideological and political education on national sentiment, craftsman spirit, and professional spirit is carried out in the mandatory course Automobile CAD/CAM/CAE for vehicle engineering major. Taking the teaching content of "Three-dimensional Modeling and Modal Analysis of Engine Camshaft" as a case study, based on virtual simulation teaching and combined with online course resources, in the traditional teaching process, the curriculum ideological and political education design and practice are performed. In the teaching process of professional course, curriculum ideological and political education is integrated to cultivate college students' professional skills such as 3D modeling, CNC machining, and finite element analysis. At the same time, it can cultivate college students' patriotism, craftsman spirit and professionalism, and achieves good teaching results.

Keywords: Curriculum Ideological and Political Education, Automobile CAD/CAM/CAE, Design and Practice

1 Introduction

Under the background of curriculum ideological and political education, it is the development trend of current college teaching reform to study the deep integration of curriculum, computer, and information technology, and to create online, offline, online and offline hybrid and virtual simulation courses[1~4]. Automobile CAD/CAM/CAE is a compulsory course for practical teaching of vehicle engineering specialties. College students are educated in ideological and political education through virtual simulation teaching and a large number of typical examples to cultivate college students to master 3D modeling and finite element analysis software skillfully[5~7]. It is conducive to training college students' comprehensive design skills for analyzing and solving engineering problems, expanding college students' disciplinary scope and vision, enhancing design awareness, and laying a good foundation for further study in the future.

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2 The Necessity of Curriculum Ideological and Political Education

The curriculum ideological and political education of Automobile CAD/CAM/CAE mainly adopts the teaching method of one course with three standards, class group construction, and practice teaching. Based on the talent cultivation plan for vehicle engineering major, the teaching syllabus and teaching plan should be improved with college students as the center in the teaching process. By combining information technology teaching methods, the ideological, political, and practical elements of the course are integrated into the construction of the curriculum. At the same time, based on the national vehicle engineering competition, various innovative and entrepreneurial projects, and participation in academic tutor research projects, a comprehensive curriculum training system is developed, which mainly includes the following quality objectives. Cultivate college students' scientific spirit for pursuing truth, being pragmatic, and being brave in exploration and experiment. Cultivate college students to have a serious, solid, persistent, and pragmatic staff culture. Cultivate college students' dedication to their jobs and strive for perfection. At the same time, the advanced industrial product manufacturing technology in China will be presented to college students by video. Cultivate college students to be brave in innovation and contribute to the construction of Made in China 2025. Therefore, the content of curriculum ideological and political education in the course mainly includes cultivating college students' patriotism, responsibility, teamwork, professional ethics, problem finding and analysis ability, collaborative learning ability, responsibility and professional identity.

By studying the course of Automobile CAD/CAM/CAE, college students can further improve their understanding of structural design, numerical control manufacturing, and computer-aided engineering of automobile parts. Moreover, there are many knowledge points of educational practice in classroom teaching. The course mainly guides college students to learn online through micro-classroom, fully mobilizes college students' class time and spare time, and cultivates their autonomous learning ability. The curriculum ideological and political education can be well integrated into the hidden teaching of professional courses, and it has achieved a good effect on moral education. The overall teaching evaluation has been recognized by peers, and a typical education case has been formed. Specifically, it can improve college students' learning enthusiasm and put an end to the phenomenon of being late for class and truancy. The number of college students participating in teachers' scientific research projects and professional subject competitions has increased. Based on peer-to-peer lectures and teaching evaluation every semester, the curriculum ideological and political education integrated into this course is affirmed. In the teaching process of Automobile CAD/CAM/CAE, according to the teaching hours, the teaching content is divided into eight parts, and the clear teaching content and requirements, curriculum ideological and political design and teaching design are given. On this basis, the case of ideological and political education is introduced for synchronous teaching, to achieve the purpose of ideological and political education.

3 Ideological and Political Cases in the Course

3.1 Based on the introduction of the course, college students are educated in patriotism

In the introduction part of the course, the teacher teaches the knowledge about enterprise CAD/CAM/CAE, advanced manufacturing technology, Industry 4.0 and Made in China 2025. Focus on explaining to college students the important meaning of Made in China 2025, and the basic ideas of industrial modernization production. The course mainly involves the meaning of Made in China 2025 and the development of new technologies, the development of China's manufacturing industry, the existing difficulties and opportunities, and the influence of advanced production technology on vehicle engineering. On this basis, college students are educated in patriotism.

3.2 Based on feature modeling operation, cultivate college students' craftsman spirit

In the process of feature modeling teaching, college students are trained to have the craftsman spirit of being earnest, meticulous, persistent, and striving for perfection. Craftsman spirit is a kind of professional spirit, which is a comprehensive embodiment of professional ethics, professional talent, and professional character. Based on sketch drawing, cultivate college students' earnest and meticulous work style. Based on feature modeling operation, cultivate college students' entrepreneurial spirit of continuous innovation, courage to create, not afraid of setbacks, and overcoming difficulties. Cultivate college students' craftsmanship, careful and serious work attitude, and persistent work style. Take good care of teaching tools and auto parts products, disassemble and assemble auto parts according to regulations, place all kinds of parts in the specified order, and place all kinds of molds and measuring tools according to regulations. After leaving the vehicle parts measurement studio and three-dimensional modeling laboratory, college students should close the doors and windows and turn off the power supply to prevent all major safety accidents.

3.3 Combining curve operation teaching to cultivate the professionalism of college students

In the process of curve operation teaching, the rules and regulations of intellectual property rights in China are conveyed in time through law and honesty, so that college students can understand the necessity of abiding by relevant laws and regulations. Cultivate college students to strictly abide by the basic code of conduct, job standards and professional ethics of enterprises. Based on the curve operation of vehicle parts, the college students' meticulous professionalism is cultivated. Based on the feature modeling of vehicle parts, the college students' professional spirit of love and dedication is cultivated.

Based on the ideological and political education content of automotive CAD/CAM/CAE, cultivate the innovative ability, teamwork ability, and professional application ability of college students. Therefore, with the goal of creating online, offline and online-offline mixed courses, the theoretical system of the main courses of vehicle engineering specialty has been sorted out. This paper analyzes the characteristics and interrelations of the main courses, removes redundancy in combination with the training objectives, and constructs the main professional knowledge network.

4 Curriculum Ideological and Political Education Implementation Strategy

On the basis of computer virtual simulation technology, combined with the content of ideological and political education, modern teaching methods are integrated into curriculum teaching. In the course reform of Automobile CAD/CAM/CAE, the aim is to cultivate college students' innovative abilities and professional application ability, besides simply adopting modern technology to realize the combination of online and offline courses. In order to realize the curriculum ideological and political education, the implementation strategy of the curriculum ideological and political education is planned to adopt the method of the three standards, class group construction.

The three standards are the saturation standard of course content, the depth standard of course development, and the standard of learning effectiveness for college students. The saturation standard of course content represents a wide range of knowledge and a certain thickness of classroom content, which shows the teacher's own adaptability to classroom teaching. Teachers should understand the teaching content, and college students should also absorb the teaching content. The course content is fully explored, which can cultivate college students' ability to adapt to social needs and focus on cultivating their creativity. Encourage college students to take an active part in the National Intelligent Automobile Competition for College Students during Automobile CAD/CAM/CAE. The standard of learning effectiveness for college students is to strengthen the cultivation of their learning methods and abilities, and improve their autonomous learning abilities, such as introducing self-learning hours into the curriculum. In order to achieve the three standards, the following points should be done in the learning process of Automobile CAD/CAM/CAE. Through the teaching of professional knowledge, we can guide college students to learn independently and cultivate their professional skills and awareness. This will contribute to the development of disciplines and the career of college students.

Automobile CAD/CAM/CAE covers most of the courses of vehicle engineering. It includes automobile structure, automobile structure design, automobile experiment, automobile parts modeling and simulation, automobile performance testing and experiment. At the same time, these contents are a separate course during vehicle engineering system. Class group construction refers to the collaborative construction of the online course of Automotive CAD/CAM/CAE with the course group as a unit, which lays a professional foundation for the subsequent courses.

Through ideological and political education, cultivate college students' cultural self-confidence, professional ethics, awareness of professional norms, craftsman spirit, improving college students' theoretical self-confidence, and teamwork ability by adding ideological and political elements to the curriculum. The main development method is the structural design of automobile parts and the overall design of automobiles, enabling college students to further master modern structural design methods of automobile parts. Through the special study of curriculum ideological and political education, we will further enrich and optimize the curriculum connotation and gradually establish the socialist ideological and political education theory with distinctive subject characteristics. Cultivate college students' ability to use computer sim-

ulation software to design the structure of automobile parts, and improve their ability to apply virtual simulation technology to solve automobile parts manufacturing problems.

Practice teaching means that the theory must be combined with practice to improve college students' practical ability based on the curriculum ideological and political education content of each teaching unit. In the teaching of Automobile CAD/CAM/CAE course, relevant research, modeling and simulation, engineering analysis, work display, and other links are added, so that college students can combine the theory with practical knowledge closely. In addition, actively encourage and guide them to participate in various vehicle competitions and lead them to do projects and complete the graduation design based on Panzhihua Automobile Engineering Research Institute.

Based on the Automotive CAD/CAM/CAE course, students' self-learning and innovation abilities in automobile parts structural design, CNC machining, and engineering analysis are enhanced through the professionalism and effectiveness of the classroom. Combining the curriculum ideological and political education and virtual simulation technology, the teaching ability of the whole teaching team is improved through class group construction. By implementing ideological and political education, the spirit of craftsmanship among college students is cultivated and their teamwork ability is improved. The professional theoretical knowledge is combined with practice, and the purpose of improving college students' application ability is truly achieved.

5 The Implementation of Curriculum Ideological and Political Education During 3D Modeling and Modal Analysis of the Engine Camshaft

5.1 3D modeling of the engine camshaft

The paper introduces the implementation of curriculum ideological and political education during Automobile CAD/CAM/CAE, teaching the content of 3D Modeling and Modal Analysis of the Engine Camshaft. The camshaft is one of the important parts of automobile engine, which requires high strength and rigidity. Therefore, the camshaft is usually cast with high-quality carbon steel or alloy steel, and can also be cast with high-quality alloy or ductile iron. On the working surface of the journal and cam, it is polished after heat treatment. Through the 3D modeling and modal analysis of the engine camshaft, the college students' feelings of the country that dare to take responsibility are cultivated, and the college students' craftsmanship spirit of cautious dedication and excellence is cultivated. In the modeling process, a single database is used to establish the 3D model, which is convenient and quick, and is convenient for model modification. When establishing the 3D model of the camshaft, it should be simplified appropriately and the features that have little influence on the camshaft model, such as chamfering and rounding, should be deleted. The 3D model of the engine camshaft is shown in Figure 1.

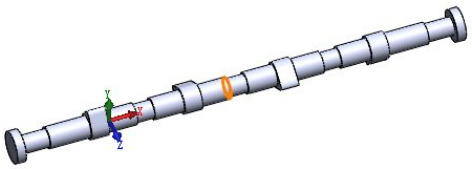

Fig. 1. 3D model of the engine camshaft.

5.2 Modal analysis of the engine camshaft

Made in China 2025 clearly puts forward that the application of digital manufacturing industry and the demonstration and leading project of intelligent manufacturing industry will be further carried out during the Thirteenth Five-Year Plan period. It has laid a solid technical cornerstone for realizing the strategy of strengthening the modern manufacturing industry. The modern manufacturing of enterprises cannot be separated from digital design and manufacturing. Thus, the CAD/CAM/CAE technology has brought a qualitative improvement to the digital product design and production capacity of modern companies. The 3D model of the camshaft established in SolidWorks is imported into ANSYS, and then the finite element analysis is carried out. When establishing the camshaft grid model, the tetrahedron adaptive mesh division method is used to create the grid model. This method can well reflect the surface morphology of complex parts and improve the calculation accuracy. The material is 45# steel, with Poisson's ratio of 0.3, density of 7850g/mm^2, and the elastic modulus of 210GPa. The grid model of the camshaft is shown in Figure 2.

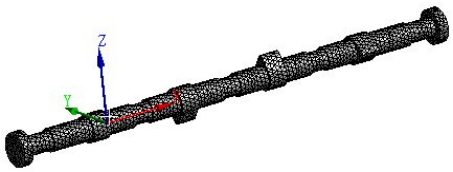

Fig. 2. The grid model of the camshaft.

The modal analysis of the camshaft is carried out, and the Block Lanczos modal method is adopted. This method has fast calculation speed and high accuracy, and it is very effective to extract camshaft modes. The actual vibration of parts is the superposition effect of various modes. Therefore, the parts have infinite mode, the vibration is the superposition effect of infinite mode. The low-order mode has a greater influence on the system vibration, and the influence decreases with the increase of the order, so the previous order is generally selected for modal analysis. The first-order to sixth-order natural frequency is extracted, and the analysis results are shown in Figure 3.

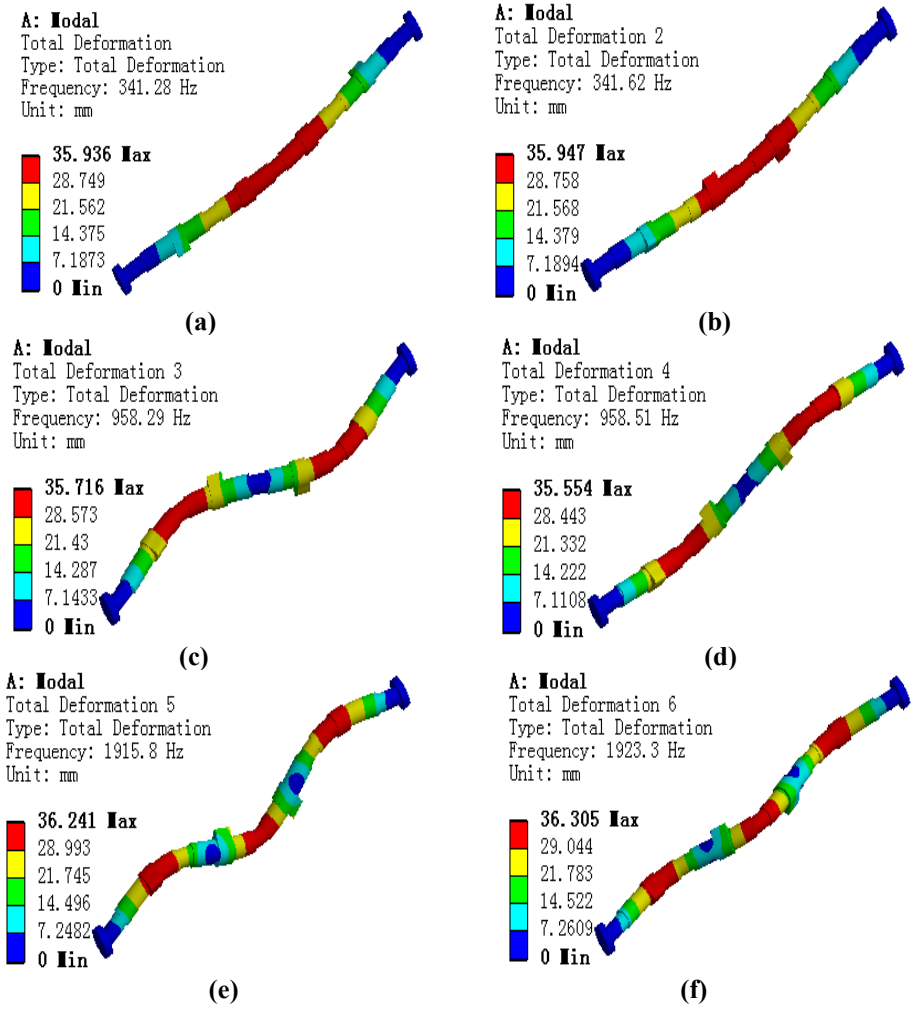

Fig. 3. The first-order to sixth-order modal shape of the engine camshaft.

It can be concluded that the first six natural frequencies of the camshaft are relatively low. As the natural frequency order increases, the modal shape of the camshaft also shows significant deformation. The values of the first-order and second-order natural frequencies of the camshaft are similar, with the first-order natural frequency of 341.28Hz and the second-order natural frequency of 341.62Hz. The camshaft undergoes bending vibration in the XOZ plane, and the maximum deformation is concentrated at the connection between the cam and the camshaft bearing. The third-order and fourth-order natural frequencies of the camshaft are also similar. The third-order and fourth-order natural frequencies are 958.29Hz and 958.51Hz, respectively. The camshaft has torsional vibration on the XOZ plane, with large vibration deformation and maximum deformation on the left and right sides. The fifth-order and sixth-order natural frequencies of are also similar. The fifth-order natural frequency is 1915.8Hz,

and the sixth-order natural frequency is 1923.3Hz. The camshaft has bending and torsional vibration along the Y-axis plane.

In the teaching process of 3D Modeling and Modal Analysis of Engine Camshafts, the teaching of automotive CAD/CAM/CAE skills is integrated into the ideological and political elements of the course. On the basis of improving college students' professional skills, it also cultivates college students' patriotism and craftsmanship spirit.

6 Conclusion

Curriculum ideological and political education is one of the current teaching hotspots in universities. The paper explores the integration of curriculum ideological and political education into the teaching of Automotive CAD/CAM/CAE courses based on the teaching characteristics and the characteristics of school management. The curriculum ideological and political education is integrated into the course Automotive CAD/CAM/CAE to cultivate college students' patriotism and professionalism. Through the teaching practice of the curriculum ideological and political education, certain teaching effects have been achieved, providing reference for the curriculum ideological and political education of the vehicle engineering courses in the relevant universities.

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