The Application of Interdisciplinary In Airborne Electromechanical System and Its Enlightenment to the Cultivation of Graduate Students' Innovative Ability

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Abstract. With the progress of science and technology, intelligent monitoring and diagnosis system has developed rapidly. Intelligent diagnosis technology, as an engineering application of artificial intelligence, has developed rapidly both at home and abroad in recent years. Research shows that intelligent diagnosis technology is a comprehensive industry integrating multiple technologies and interdisciplinary disciplines, and it is also a partial epitome of contemporary scientific and technological progress. Combined with the development of intelligent diagnosis technology o**f airborne** electromechanical system and the important task of colleges and universities as the undertaker of high-end talent training, this paper puts forward that the current talent training mode needs to be adjusted according to the needs of science and technology, and teaching practice reform should be carried out from professional fields, discipline categories, practical training platforms and other aspects, so as to provide reserve talents for China's scientific and technological progress.

1 Introduction

In 2018, the guiding opinions on accelerating the construction of "double first-class" in Colleges and universities pointed out that "in view of the major national strategies and the development direction of the frontier of disciplines, we should take service demand as the goal, take problems as the guidance, take joint scientific research as the traction, take innovative talent training mode as the focus, rely on scientific and technological innovation platforms, research centers, etc., and integrate multidisciplinary talent team resources". In the educational reform of "intelligent manufacturing", "double first-class" and "new engineering", interdisciplinary talent training is an important way to cultivate top-notch innovative talents. Graduate students are the core force of China's future academic research and technological innovation, so interdisciplinary graduate training is the core of higher education reform.

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In recent years, with the rapid development of artificial intelligence and network communication technology, the airborne electromechanical intelligent monitoring and diagnosis system has also made great progress. Through in-depth analysis, the airborne electromechanical intelligent monitoring and diagnosis system involves multiple disciplines, disciplines and fields. It is not only the comprehensive embodiment of cross disciplines, but also testing technology, communication technology, control and diagnosis technology, network communication technology The integration of computer technology and other multiple technologies is, to some extent, a comprehensive embodiment of the progress of electromechanical testing and control technology.

2 Interdisciplinary in airborne electromechanical intelligent diagnosis system

The airborne electromechanical intelligent monitoring and diagnosis system involves control, communication, computer and other disciplines. In the process of graduate talent training, whether from the social needs of talents, the relevant training system of the college, the teacher team of talent training, or related shared resources, it needs close cooperation, unified coordination and allocation. The overall logical framework of the overall talent training mode basically involves the contents shown in Figure 1:
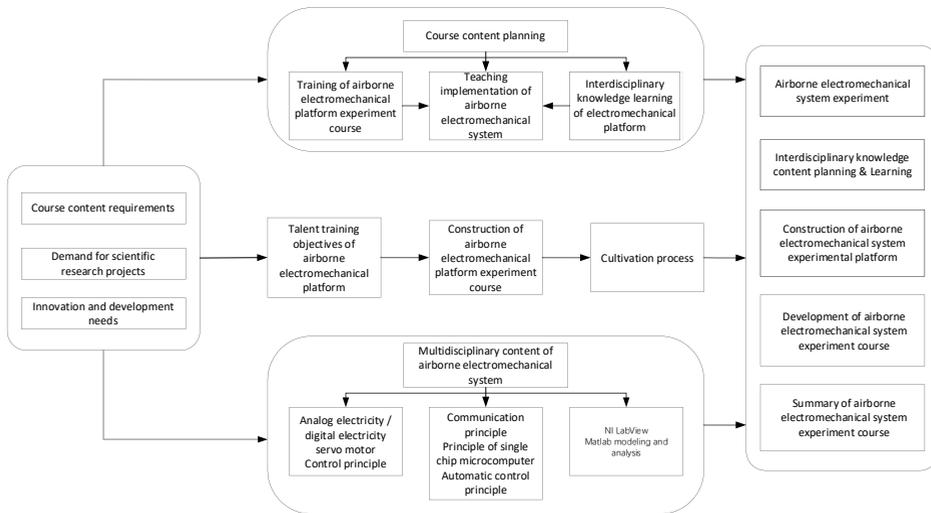

Fig. 1.

From the logical framework of talent training mode of airborne electromechanical system and combined with the fault testing and diagnosis system of airborne electromechanical system, the main professional disciplines involved in airborne electromechanical system include:

2.1 Sensing test technology

In the process of airborne electromechanical intelligent testing and diagnosis, it is necessary to detect the state of the airborne system. Therefore, the acquisition of various signals requires corresponding signal sensors, such as vibration sensors, speed sensors, displacement sensors, acceleration sensors and noise sensors. Therefore, sensor testing technology is a knowledge system that must be mastered in the learning process of airborne

electromechanical systems, and it is also one of the professional contents that must be involved in the testing field.

Fig. 2. Sensor test application

2.2 Circuit design and control technology

In the test of airborne electromechanical intelligent diagnosis system, signal acquisition is carried out by using various sensors, but usually the collected signals cannot be directly analyzed. Corresponding signal conditioning needs to be carried out on the signals, such as signal amplification, high-low pass filtering, frequency voltage characteristic conversion, etc. Therefore, corresponding circuits need to be built to process the front-end signals, and corresponding control systems need to be built to further process the signals, Figure 3 shows the frame structure of signal acquisition and processing.

2.3 Communication technology

In the process of monitoring and diagnosis, the airborne electromechanical intelligent monitoring and diagnosis system needs to upload the relevant test data to the data processing center. The diagnosis system needs to establish the corresponding data transmission system and adopt different communication transmission technologies, such as LAN technology, wireless technology, Bluetooth communication technology, serial communication technology, etc. therefore, the mastery of communication technology, the understanding of communication interference technology, the formulation of communication protocol, etc, Monitoring and diagnosis is also a very critical link. Only by establishing a stable and reliable data transmission system can the obtained data be reliable and provide guarantee for the correctness of testing and diagnosis.

2.4 Big data analysis technology

With the advent of the era of "Internet +" and big data, "Internet + aviation" has become an opportunity for the aviation industry to grow again. In the future, aviation will develop towards integration, informatization and intelligence. The detection and maintenance of airborne systems are also developing towards integration and intelligence. During the maintenance and testing of the airborne system, a large amount of data will be generated. These data contain a large amount of information that is crucial to the safety, flight efficiency and maintenance of the airborne system, such as vibration data, noise data, torque data, coaxiality data, installation position data, etc. These data are crucial to a detailed understanding of the performance of the airborne system. By comparing the data in the "big database", It can deeply understand the state characteristics of the airborne system, and analyze the potential fault, damage tolerance and fatigue tolerance of the system by

analyzing the test data and comparing it with the big database data, so as to prevent the trouble before it happens and ensure the normal operation and safety of the system.
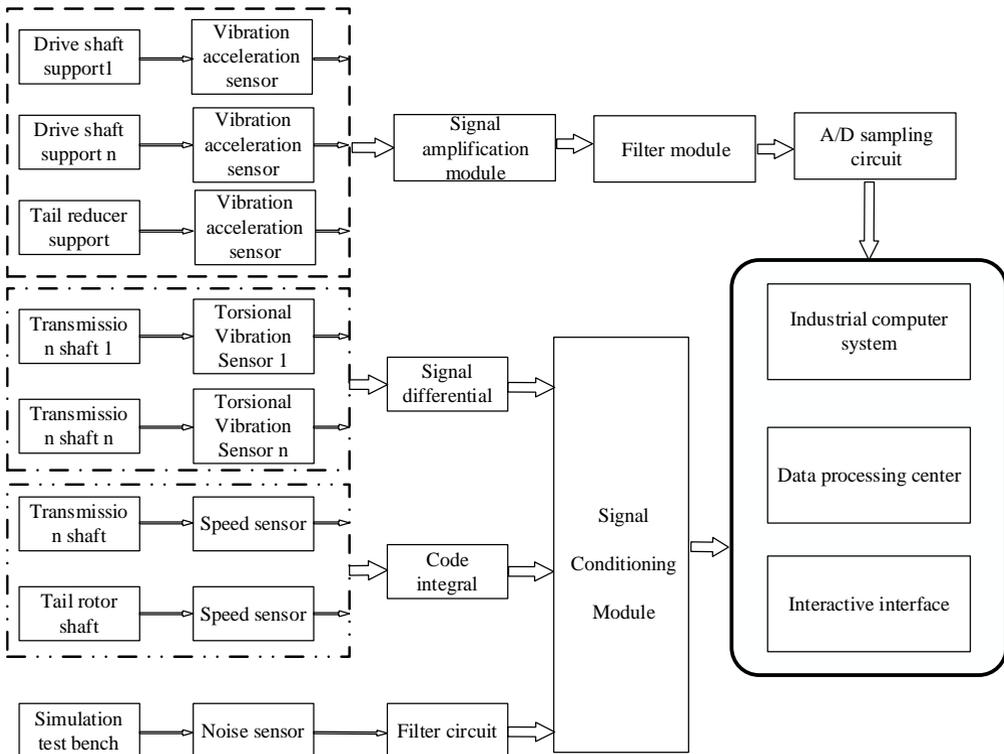
Fig. 3. Logic block diagram of signal acquisition and conditioning

2.5 computer technology

The development of computer technology has become an indispensable technology in scientific research and engineering design. It plays a key role in a large number of complex numerical calculations and processing. In all kinds of testing and data processing systems, computer technology mainly completes the processing of relevant data, the communication between upper computers, the design and manufacture of interactive interfaces, etc. Therefore, the role of computer technology in airborne electromechanical systems is particularly critical, therefore, whether engineering students or science and engineering students, computer technology will play a vital role in learning, and it is particularly critical for the development of diagnostic system in airborne electromechanical system testing.

The current professional system of various disciplines is a large-scale system integration with high integration and intersection, involving the professional direction of control, information communication, computer data, mathematical logic algorithm and information communication. If you want to complete the overall planning, design and implementation of intelligent testing and control and other related projects, The corresponding professional direction should carry out integrated learning in content, so as to integrate interdisciplinary knowledge.

3 Engineering and innovative talent training in colleges and universities

From the categories of disciplines involved in the development of airborne electromechanical technology, it is not difficult to see that today, with the advancement of science and technology; it is difficult for a single discipline to meet the needs of social development. A professional direction for knowledge reserve, learning and mastery. This development trend is also in line with the relevant policies of the Ministry of Education. At the end of 2014, the official website of the Ministry of Education issued the "Opinions on Improving and Strengthening the Construction of Graduate Courses". In the process of cultivating postgraduates, their courses should be targeted in the design. According to the characteristics of majors and disciplines, different disciplines and different majors can be set up, that is, multi-disciplinary cross-connection and multi-professional cross-infiltration, to have Plan to build an interdisciplinary curriculum system, and then form a corresponding teaching plan.

3.1 Structure interdisciplinary professional curriculum system

To implement the "applied, innovative and compound" talent training concept in the process of talent training in colleges and universities, the Engineering Training Center of Tsinghua University is committed to exploring the reform of the "creative, innovative and entrepreneurial" compound talent education model. Majors such as majors, control engineering majors, communication engineering majors, and computer majors realize the development of interconnected education, learn from the idea of "generalized engineering education", and highlight the cultivation of "complex, applied and innovative" talents. According to the talent training goals of the "Engineering Training Center" and the requirements for talent quality in industries such as unmanned driving and artificial intelligence, the direction of professional talent training has been established from the perspectives of knowledge structure, ability structure, and quality training. Its structure diagram is shown in Figure 4. Show.
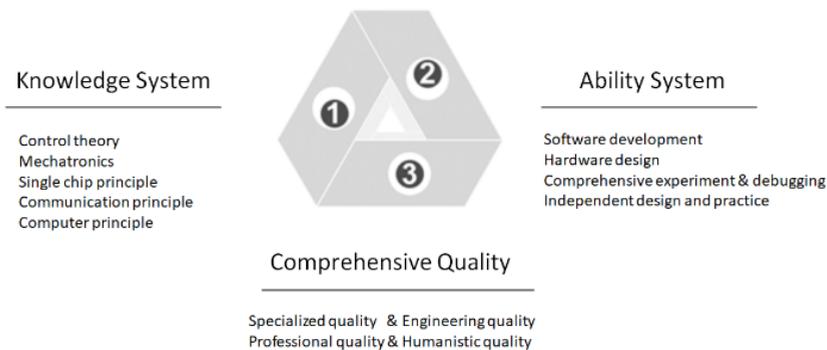

Fig. 4. Structure of talent training program

Knowledge structure: solid basic knowledge of control engineering, computer engineering, communication engineering and other majors, deep integration of various professional knowledge systems, and realization of an interdisciplinary knowledge structure system on the overall structure, "oriented by scientific and technological needs and centered on talent training", to build a complete interdisciplinary system teaching framework.

Ability structure: solid engineering practice ability, the center provides enough equipment and facilities, professional software and hardware development and debugging

platform, so that in the process of talent training, students have enough exercise space and platform to show a high degree of system knowledge and application practice. integration capabilities.

Quality structure: Build a good training space, in the process of highly combining knowledge and practice, gradually infiltrate excellent engineering professionalism and professionalism, broad vision and active thinking innovation, excellent communication skills and teamwork spirit. Students' brain improves students' professional quality, humanistic quality, moral quality and so on.

3.2 Build a professional training platform for interdisciplinary talent training

The cultivation of innovative talents in colleges and universities is a systematic project, which requires cooperation and multi-party promotion in several aspects, such as the talent training and setting end of the department, the leading end of the tutor team, the building end of the scientific research training platform, and the students' cognitive practice end, to achieve the expected training objectives.

The cultivation of interdisciplinary talents requires a professional team of teachers. The team of teachers can be teachers of different professions inside or outside the school. The team of teachers of different disciplines can gather professional knowledge from different disciplines, and the scope of penetration between disciplines is expanded. Different practical projects can be constructed according to the needs of discipline development and talent training, and at different stages of project research, experts in the required fields can be integrated to solve emerging new problems, creating a multi-disciplinary and multi-perspective teacher-student linkage model.

For the object of talent training, the collision of multidisciplinary and interdisciplinary ideas can arouse the interest and enthusiasm of college students and postgraduates. The field of knowledge is constantly expanding, making up for their shortcomings. At the same time, the entire learning process is also a deconstruction of thinking patterns and knowledge systems. and the process of regeneration. Although this learning process is relatively difficult, the process of knowledge integration is also cultivating students' independent thinking and judgment ability, generating new academic skills in the experience of harvest and growth, cultivating graduate students' innovative ability, and satisfying "artificial intelligence". High-level ability requirements of the times. Experience different interdisciplinary learning, penetration of interdisciplinary, and be able to understand the latest academic knowledge and technical needs.

For practical projects, it is a crucial link in the development of cross-disciplines and plays a role as a bridge. Therefore, there should be enough scientific research project platforms and practical operation platforms in the whole process for students to conduct in-depth research and hands-on practice. Practice, and the project practice platform should focus on multi-disciplinary, multi-professional, to cultivate and exercise students' comprehensive ability. According to the mode of interdisciplinary talent training, using interdisciplinary education theory, system science theory and higher education theory, the components and main characteristics of the interdisciplinary training mode are explored. The training route structure is shown in Figure 5.
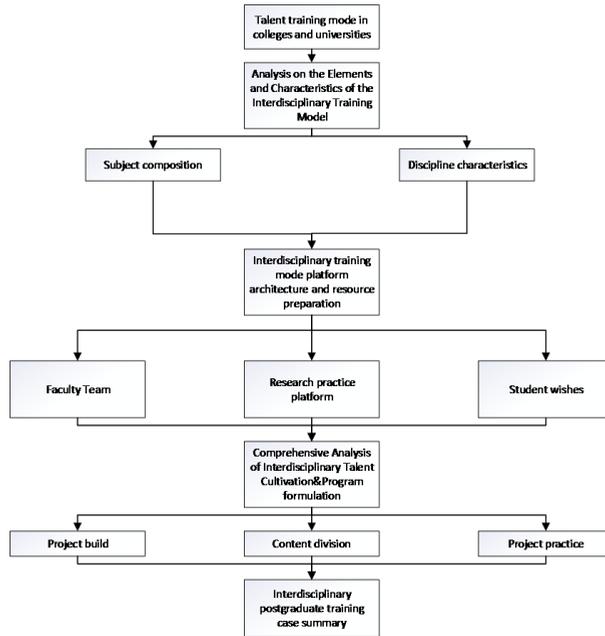
Fig. 5. Interdisciplinary talent training route block diagram

4   Conclusion

From the technical disciplines, professional categories, interdisciplinary to high integration involved in the rapid development of intelligent driving, with the continuous progress of the society and the gradual improvement of science and technology, the mastery of multi-disciplinary integration and in-depth study of interdisciplinary are the current college students. Therefore, driven by the national construction of "first-class" universities and "first-class" disciplines, all universities and disciplines should take the initiative to serve the country's major strategic needs and meet the needs of social and economic development. The reform of the contemporary college student training system, to improve the quality of personnel training, with the goal of improving the original innovation ability, constantly explore new methods and new measures for the quality of personnel training.

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