

## The Exploration of Control Engineering Full-time Postgraduate Education Pattern

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**Abstract.** According to the culturing on the full-time master degree in the field of control engineering, practical experience summary and discussion have been made in targeting training goals, setting up a course, improving the ability of engineering practice, researching cooperation, monitoring system, establishing practical assessment and evaluation mechanisms and building faculty, an effective way has been explored for training control engineering full-time masters.

### Introduction

Exploring in practice full-time graduate professional degree training mode which makes the fresh graduates as the main source of students, promoting professional graduate education and improving the quality of personnel training significantly and building and improving the Postgraduate Degree education system adapted to the needs of economic and social development gradually, is an urgent need for colleges and universities to study and solve problems, are urgent problems for colleges and universities to study and solve.

Since Northeast Petroleum University (hereinafter referred to as "my school") has been given the right to grant master's degree in control engineering, it has cultivated a large number of high-level application, complex engineering and management personnel for business and society and accumulated a wealth of training experience combining with the advantages of the school. Based on these experiences, playing educational advantages of Combining production, teaching and research, we make a useful exploration in the culturing on the full-time master degree in the field of control engineering.

### Direction of Research and Objectives of Training

Control Engineering applying control theory and technology is an important engineering field which meets and realizes the growingly automated and intelligent needs in the field of modern industry, agriculture and other socio-economic. Control Engineering is based on cybernetics, information theory and system theory with engineering applications as the main purpose, the application of which is across all areas of industry, agriculture, transportation, environmental, military, biological, medical, economic, financial and social. Combining with my school education, research features and the needs of local economic and social development, we summarize the research directions in the field of control engineering in the following nine: Intelligent control theory and applications, advanced control theory and applications, control theory and applications of complex systems, robust control and nonlinear control, fault diagnosis and fault tolerant control, computational intelligence and intelligent systems, intelligent information and control, pattern recognition and intelligent information processing, speech signal processing and applications. These research projects not only close to engineering practice, but also reflect the new progress and the new demands in the field of control engineering, in the meanwhile, they also play a positive role in guiding candidates applying this major and professional teachers doing research activities.

Full-time master's degree in the field of control engineering is a professional degree associated with engineering qualifications; its specific training objectives are identified as:

Based on professional experimental platform and practical base, originating from students, training the engineering talents with innovative spirit and enterprise-class practical ability as the goal, highlighting the

strengthening of professional practice as a means, making use of practical and exploratory case studies, corporate horizontal issues and graduation designs originated from practical problems as a carrier, using efficient process control and excellent teachers as the protection, the training mode of full-time professional degree postgraduates in the filed of control engineering which is scientific, standardized, complete, practical and full-featured must be researched and built to becoming an effective way of exploring the cultivating mode of the full-time professional degree postgraduates.

We should establish and improve the provisions associated with training objectives, training process, training links and dissertation requirements of the full-time master degree education. An talents training model of a full-time master degree in line must be explored, so that full-time professional degree postgraduate training which is composed of fresh graduates outstand engineering practice and innovation ability, to grasp the solid basic theory and broad expertise, to gain a strong ability to solve practical problems and to be capable of taking professional or managerial jobs, then become a high-level applied expertise of good professional qualities.

### The Training Methods and Curriculums

Full-time professional degree postgraduates adopt training methods combining courses course of study and professional practice with dissertation. Tutorial responsibility system is implemented, which is mainly composed of school instructors and employ outside mentors who should have senior technical titles and have a wealth of practical experience participating in the guide works of practice process, research projects and other aspects.

Implementing credit system of course learning and teaching practice, the total credits are not less than 32. The credits of course learning are not less than 26, including 6 credits of public courses, 6 credits of basic theory courses, 8 credits of professional courses, at least six credits of elective courses and compulsory courses, as specified in Table 1. Elective courses in general elective by students, agreed by teachers. Full-time graduate student in Master Degree of equivalent or cross specialty specialized in control engineering, should learn two to three main courses of the undergraduate in the own area, scores are not included in the total credits, the course is determined by the teacher according to the actual situation.

Tab.1 Full-time professional degree postgraduates' curriculum in the filed of control engineering

Course categories	Course Title
Public Courses	Introduction to Dialectics of Nature, Theory and practice of scientific socialism, First Foreign Language
Basic theory courses	Matrix Analysis, Modern probability and stochastic processes, Modern analysis
Professional and technical courses	Linear system theory, Adaptive Control Theory and Applications, Optimal Control Theory and Applications
Electives	Fuzzy Control Technology, Systems and control theory, linear algebra, Robust Control, Intelligent Control Technology, Advanced Process Control
Compulsory link	Literature reading, Participate in academic reports or academic lectures more than 5 times

Table 1 shows the curriculum, public class meets the requirements of National Engineering Master of Teaching Steering Committee, other courses corresponds to the aforementioned research, taking into account the knowledge of the needs of different studies (design) topics. Considering that fresh graduates as the main source of full-time professional degree graduate students, they already have a good foundation of classical control theory, so watch a curriculum emphasis on the basic theory of contemporary and modern control theory-based learning. In the settings of professional and technical courses, elective courses, highlight the engineering application background and practical technology, all the teaching content is the theory with practice and focus on the practical application of the method. Specifically, selecting the essential basic knowledge of the theoretical content in the course, the most commonly used method in the practical application, are two parts of theoretical foundation. We should speak application instance as much as possible based on these theories so that students can develop

an understanding of the essence of the theory, and grasp application and debugging methods and understand the application effect and know how to apply effects to be analyzed.

In the actual training process, we make the school teachers recognize the importance of the professional practice teaching of a professional degree student through seminars and other forms and mobilize the initiative of them to contact enterprises and establish various forms of practice base or joint training base in order to ensure practical teaching of the professional degree postgraduates implemented and students' practical ability through practice teaching strengthened, this can strengthen the ties between professional degree postgraduates' education and the employing units and explore the interaction mechanism of supply and demand of talents actively for the full-time professional degree postgraduates to provide a stable base for professional practice and create good conditions for their employment in the meanwhile.

In the implementation process of professional practice, taking fully account into the current realities, we adopt principles of combining centralized practice with paragraph practice, campus practice with off-campus practice and professional practice with thesis work and a variety of flexible concrete ways because of the full-time professional degree graduate being novelty. For example, we arrange the professional practice for postgraduates relying on joint postgraduate training base, professional practice base or graduate business stations; we arrange the professional practice for them relying on the research projects undertaken by school teachers and outside instructors.

## **The Graduate Training Mode Reform Measures**

### **Research on improving the cultivating model of the full-time professional degree of master of engineering practice ability**

Full-time master of engineering education that its practice in the curriculum should occupies an important position is to cultivate high-level specialized personnel's capable of good creative and practical abilities, the curriculum of which should adhere to the practical application and professional demand as the guide and the improvement of integrated literacy and the application of knowledge and skills as the core, so that students' practical ability can be significantly improved. So when we develop the training programmers of full-time professional postgraduates, we should pay attention to the difference not only between it and academic postgraduates but also between it and part-time master of engineering to achieve differentiation and diversity training. The hours of credits in the practice should be increased to ensure the smooth conduct of practice. We should also offer some courses focusing on improving students' actual working capacity and engineering application capabilities and invite business experts to teach practical links courses.

Teaching content emphasize the combination of theory and application and teaching process emphasize the use of team learning, case studies, field studies, simulation training methods and focus on students' awareness and capacity of researching practical issues and increase practical work experiences and improve professionalism and employability and entrepreneurial abilities. Maintain curriculum system especially professional electives a certain degree of openness and increase or decrease keeping pace with the needs of the country's major, such as offering courses currently around low carbon economy, energy conservation and other programs. We can encourage students to break discipline barriers in the choice of subject to carried out research on interdisciplinary cross-practice project issues.

### **Research on the training mode of the full-time professional degree postgraduates with cooperation of production, study and research**

Training masters with the cooperation of production, study and research which is a new education model that combines the theoretical study with practical activities together is an important measure to protect the quality of professional degree education to be good to improve masters' overall quality and ability. According to the analysis of the masters' training mode with the cooperation of production, study and research, there are eight kinds of main masters' training modes with the cooperation of production, study and research both at home and abroad at present, they are respectively training masters in joint relying on projects, establishing personnel training and scientific research base in joint, establishing real economic to train the postgraduates, introducing enterprise personals who are also part-time tutors at the

University, offering professions combining schools and enterprises to train masters, founding university science and technology park in joint to cultivate postgraduates, building cooperative research centre and university commissioned by the business customizes to train them. In this topic, cultivative modes will be explored that suit to my school situation in the filed of control engineering and are with operability to improve the quality of training full-time masters.

### **Research on process monitoring system of training full-time professional degree postgraduates and practical evaluating and assessment mechanism.**

Full-time professional degree training work has just started, so each training unit should establish a sound management system, strictly implement standardized management, and clear the training requirements from the system and normal training process. Implementation of process management is as important as goal management, we should grasp every aspect of courses, professional practice and the dissertation solidly. For a long time, in the culture evaluation system, monitoring and evaluation of the quality of training the main emphasis on academic needs, the ones of quantifying the practical application are less, this restricts the improvement of the quality of training full-time professional degree graduate students. And therefore, establishing control engineering full-time professional degree graduate education evaluation system as the basis on scientific nature, purpose, operational and rationality can effectively strengthen macroeconomic management and guidance of practical innovation ability, at the same time, it is also possible to scientifically evaluate the effectiveness of their teaching, and improve practice teaching system, promote the improvement of the quality of teaching graduate professional degree.

### **Faculty Construction**

Enhance teachers' professional quality workout. For less practical experience features of a young team, we combine with research direction and establish a research team. Teachers with research projects as the carrier go to the factories, workshops, to understand the actual production, thus deepen the understanding of the subject knowledge, understand the frontier and clear the need of social talents, they can well implement specialty training requirements in the way of letting students focus on the needs of society usually, having professional and open mind and teaching targeted. To further strengthen the engineering background of faculty and teach in close connection with the actual production, we hire two part-time professors from the production line of experts and senior technical staff to carry out seminars and expand students' horizons. Introduction of a corporate teacher not only served as a bridge of cooperation between schools and enterprises, but also improve the practice of teaching.

Clear double tutor training duties. School teachers have a strong theoretical foundation and rich experiences to guide, but are not very familiar with the business background in particular sectors and practical issues, so they are mainly responsible for academic advising, placing emphasis on leading students to run for scientific exploration spirit. External mentors engaged in the practice of their unit work, so they have a deep understanding of technical problems in their sectors, and they are responsible for engineering practice ability of professional degree graduates to highlight the status and role of school teachers and strengthen the cultivation of engineering practice session. Through the implementation of two-way mentoring system taking advantage of different instructors, it will be more possible to fully enhance the graduate research and practical application skills.

### **Summary**

In the application-oriented targeting training mode of control engineering full-time degree postgraduates, each train links are focused on comprehensive practical ability of training, training mode and specific methods of full-time professional degree graduates are constantly exploring, I hope this text can be benefit for continuously and gradually improving training mode of full-time professional degree graduates.

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