

Discussion and Construction of “Emerging Engineering” Course System in Robot Engineering

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Abstract: The construction of course system is discussed for change in demand on talents in the new technique and new industry on robot engineering and relevant fields, in the face of "the emerging engineering". Firstly, the construction approach is taken as the discussion object; and then, contents of course system proved to be formulated; finally, the frame of construction of course system is constructed, with the reference for course system.

1. Introduction

The industrial transformation and technological innovation in robot engineering and relevant industrial fields can be accelerated enormously by new scientific and industrial revolution in the world, the contradiction between demand and supply on senior talents about the new technology and industry is increasingly obvious. The talents training schemes based on integration of production and education of "the emerging engineering" about the new technique and industry have been proposed by educational department since February in 2017^{[1][2]}, with a serial of documents, "information about research and practice on ‘the emerging engineering’" and so on, as well as several guidelines, "Fudan University consensus", "Tianjin University operation", "Beijing guideline".

Robot engineering profession associates with many new technologies and industries in the integration of automation, intelligent control, mechanism, electron, computer and so on. However, the courses on robot engineering and relevant profession are not satisfied with the demand for talents on the robot engineering^[2], without the combination with "the emerging engineering" industries. The construction of "emerging engineering" course system is extremely necessary for the settlement with contradiction for demand and supply about talents.

2. Course System Construction Approach

The demand for talents in new technique and industry in robot engineering profession becomes the leading factors in course system construction, so that the aim at course system construction is course system optimization, for the undergraduate student engages in relevant work. The method of course system construction seems to be the understanding of relevant field talent demand and reasonable course optimization.

The college or university offering robot engineering profession can invite experts in vocation or enterprise and call in full-time teachers, department leaders to build up course system construction group and to carry out planned investigation of demand for talents. The group organizes a series of exchange activities such as lectures, training, document reading guidance, and regular seminars. In this way, full-time teachers and department leaders may fully understand the "emerging engineering" robot industry development trend and integration idea of production and education. This provides a suitable opportunity to be familiar with the robotics-related job content, job characteristics, and job capabilities in detail and to draw up a reasonable enterprise, college and university visit, investigation and training plan.

The group summarizes suggestions and research experiences of full-time teachers, experts and

department leaders to determine the central competencies, central course knowledge, theoretical knowledge and competencies of basic courses and to scientifically evaluate the robot engineering profession, in which these competencies and knowledge can be required for students to engage in "the emerging engineering" robot technology-related work. The above determination should be taken as the main course optimization path that contents and component of central courses and basic courses are scientifically joined along with. The project training plan from the engineering introduction to innovation should be considered. And then, customer ideas, product design, implementation, operation, evaluation, and other work process are integrated into the curriculum. Finally, a "emerging engineering" robot engineering professional course system, tightly joined with the theoretical layer and practical layer, is built up.

3. Course System Contents

The construction of the course system must fully build the effective connection between the professional curriculum and the needs of new technology and industry talents. The course system content includes professional positioning, job orientation, central competences, central curriculum, and basic curriculum:

Job orientation and professional positioning: The design and debug of robot workstation and production line is the job orientation. Design, integration, and development of robot systems may be the main work in robot design and debug, directly determine the development of new industries and technologies in the "emerging engineering ". Therefore, the work should be taken as professional positioning and the positions that students will face after graduation.

Central competences: according to job skill difficulties from low to high, the order of mastering the central competences of the robot profession is: 1. Integration capabilities of industrial standard robot control systems; 2. Maintenance, diagnosis and inspection capabilities of industrial standard robots; 3. Design capabilities of non-standard robots; 4. Innovation and research capabilities of robot systems.

Central curriculum: The course system construction group firstly takes a comparative analysis of courses related to central competence. After that, the group fully discusses the role of project-based engineering training on courses and summarizes the relationships and differences between courses, and then, optimizes the courses components to ensure that there is a strong level, progressiveness, and practicality among course contents. Finally, four kinds of central course corresponding to the these four central competences are formed so that students have the ability to complete the theoretical learning and training of central courses in scientific and technological innovation projects, to master the relevant skills in the "emerging engineering" robot engineering profession.

An offering order of four kinds of central courses are followed by grade, progressiveness, and practicality: 1. Introduction to Robotics, Industrial Robot Programming and Simulation, Motion Control Systems; 2. Detection and Robot Sensor Technology; 3. Mechanical and Basic Robotics, Hydraulics and Pneumatics; 4. Field bus technology and system integration technology for industrial robots. In addition, the offering order of the central courses of these four kinds is the same as the order of mastering central competences, and each kind of central course corresponds to a central competence.

Basic curriculum: The course system construction group should also adopt the same course construction method, discuss the basic professional skills and professional basic knowledge contained in central curriculum, optimize the organization of basic courses, and enable students to have the professional basic knowledge and skills to complete the central courses learning.

In order to be consistent with above four kinds of central courses, basic courses are also divided into four kinds: 1. Circuit, electronic technology, motor drive technology, automatic control principle and simulation technology; 2. Signals and systems, single-chip microcomputer principle and interface technology; 3. Engineering drawing, mechanical design foundation, PLC control technology and application; 4. Industrial fieldbus technology, system integration technology.

A framework of the "emerging engineering" course system for robot engineering majors, with

strong level, progressiveness and practicality, including job orientation, professional positioning, central competence and central curriculum, has been formed through the above course system contents, and offers the effective connection between the teaching of robotics engineering courses and the needs of new industries and technical talents in the context of "emerging engineering", as shown in Figure 1.

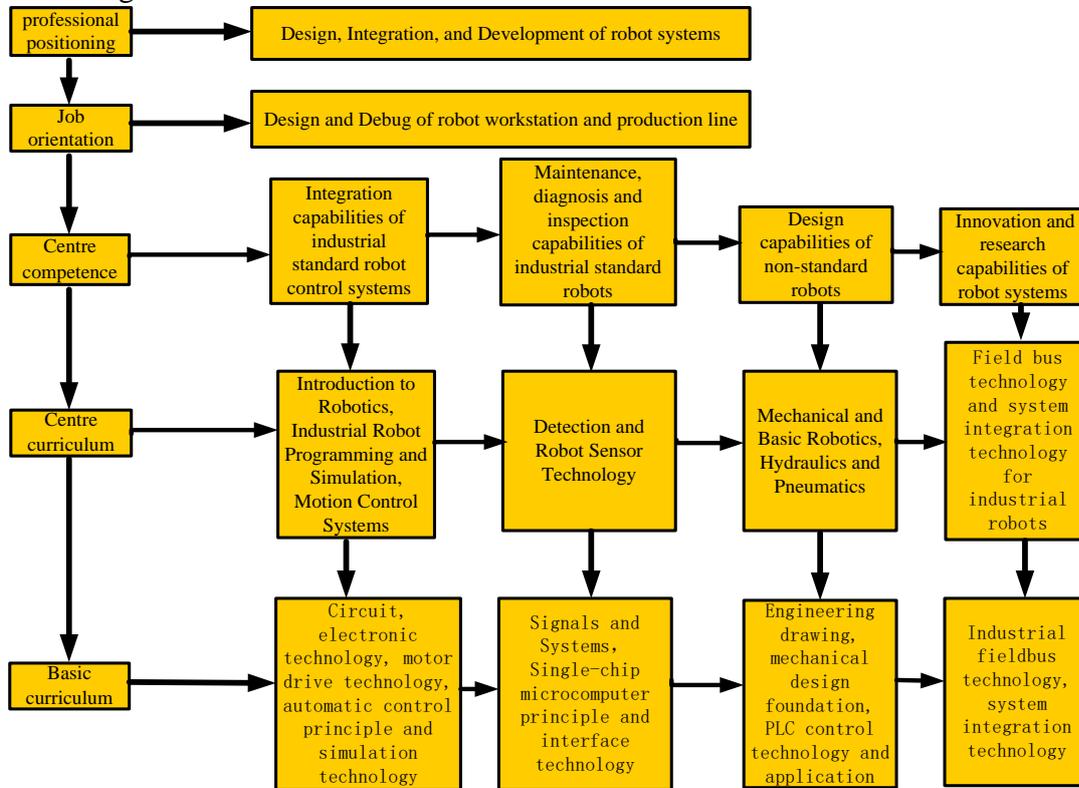


Fig 1 Frame of construction of course system

4. Conclusion

The construction method and content of the robotic engineering course system is discussed, based on the "emerging engineering" background and the problems on the talent education of robot engineering profession. It is a reference about theoretical and practical compound talent education of "emerging engineering" robot engineering.

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