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Teaching Reformation of PKPM Course Based on the Idea of Structural Design

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Abstract

Combining the three main processes of structural scheme, structural calculation and construction drawing design, the idea of structural concept design, structural optimization design and structural measures design are integrated into the PKPM software teaching practice. Using engineering example teaching method, the PKPM software teaching is divided into three modules: structural concept design, structural optimization design and structural measures design. The design thinking mode based on conceptual design, structural optimization calculation and structural measures design is gradually integrated into the PKPM curriculum teaching, and the teaching mode with equal emphasis on knowledge and ability in theory and practice teaching is constructed.

Keywords: Teaching of PKPM course; Structural design; Teaching reformation

1 Introduction

With the development and improvement of computer hardware technology and building structure analysis theory, computer-aided design system has been more and more widely used in the field of architectural engineering design [1]. PKPM software is one of the most widely used structural calculation software in China. Based on this, the PKPM course is widely opened as a professional basic course in civil engineering, which is also a professional course with practicality and practicability.

In the traditional teaching mode of the PKPM course, the single teaching mode for the purpose of software using has been used in most universities. The main content of the course teaching focuses on the operation process of each module of the PKPM software, ignoring the application of structural concept design idea, professional basic knowledge and current national standards to the software teaching process. There are some problems in structural scheme, calculation diagram and evaluation of calculation analysis results which can not conform to the structural concept design and structural design specifications.

2 PKPM teaching mode based on the idea of structural design

This paper constructs the PKPM course teaching model integrating the concept of structure, optimal design and Structural measures. The whole course is divided into three training modules: structural concept design, structural optimization design and structural measures. And the engineering example teaching method is also used to enhance students' ability of architectural design and engineering application.

2.1 The teaching of structural modeling based on concept design

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Conceptual design of structure based on the basic design principles and ideas of the mechanical relationship between the whole structure system and the sub system, material properties, construction technology, structural damage mechanism, experimental phenomena and engineering experiences, is to select a reasonable structure scheme to realize the functional requirements. Integrating conceptual design thinking into the teaching course of PKPM Software, it is necessary to train students' conceptual design ability [2]. Figure 1 shows the main content of PKPM modeling teaching based on structural concept design.

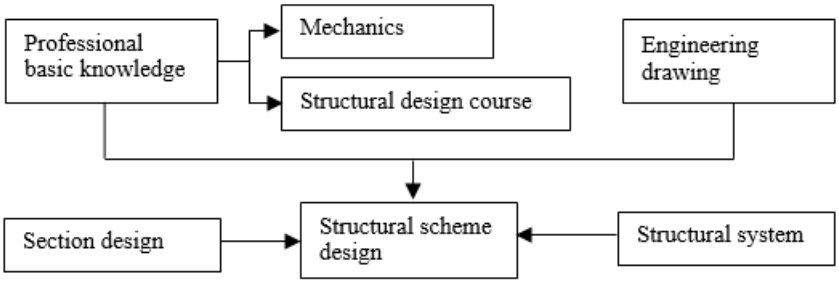

Fig.1 content of PKPM modeling teaching based on concept design

The selection of structural system and the layout of components are determined by using the basic mechanical knowledge. The mode of thinking based on the concept of bearing capacity (strength), rigidity and ductility is helpful to simplify the structural model. In the course of PKPM modeling teaching, the basic functions and main technical conditions of PKPM software are introduced, the menu command and its operation steps, and the operation steps of construction drawing using the software internal force calculation and reinforcement results are explained in detail. Combined with engineering case teaching, it can make students familiar with PKPM software operation process, and master the method of structural concept design and modeling analysis.

The PKPM modeling teaching with the concept of conceptual design helps to strengthen students' understanding and application of the basic knowledge of mechanics. At the same time, in the process of PKPM modeling and analysis, it has a good grasp of the relationship between the overall and local structure, which is beneficial to the coordination of the external space and internal structure, and can avoid the large modification of the structural components in the later stage.

2.2 The teaching based on the idea of structural optimization design

The structural design is to establish the basic structure model by using the basic knowledge of the specialty, and systematically analyze the structural form, and finally complete the construction drawing. Under the condition of the established structural system, structural optimization design is to seek structural function (safety, application, durability) to achieve the most rational state by adjusting the material grade, component size, section type and other factors. Based on the idea of structural optimization design, the main contents of SATWE module calculation and analysis teaching in PKPM course are shown in Figure 2.

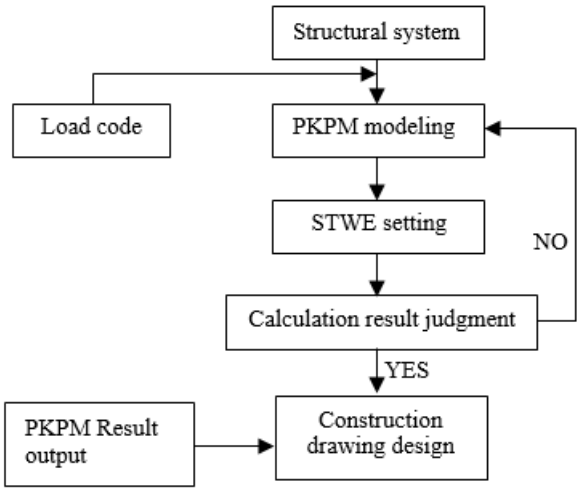

Fig.2 content of PKPM calculation analysis teaching based on structure optimization design

It is not only satisfied with the whole process operation of students' structure design with PKPM software, but also pays more attention to the optimization analysis of structural calculation results. Using engineering example teaching method in the course teaching, the settings of SATWE calculation parameters is explained combined with the current standards. Through the computer experiment operation, to guide students to accurately judge the calculation results (internal force, displacement, cracks, etc.) is in line with the specifications, the load diagram under various conditions is correct.

In specific SATWE module analysis of structural calculation results evaluation, not only to analyze the local component indicators, but also to analyze the overall structure of the indicators, such as cycle ratio, displacement ratio, stiffness ratio, stiffness to weight ratio, shear weight ratio, overturning moment ratio and other indicators [3]. If the results are not reasonable and do not meet the standard requirements, it should look for reasons based on the basic professional knowledge, and put forward the improvement measures and schemes. By adjusting the section or arrangement of the component to find the reasonable structural form, so that the structural analysis and calculation results can meet the requirements of the standard

2.3 The teaching based on structural measures

Structural calculation analysis is an important content to ensure the structural scheme to meet the requirements of the specification. After the completion of structural analysis and calculation, it is necessary to finish the construction drawings through the calculation results. In terms of steel type, reinforcement spacing and so on, the requirements of structural measures should be met. Conceptual teaching based on structural measures is to integrate the construction measures of basic components into the software teaching process. The purpose is to complete the construction drawing. The main content of the construction drawing teaching of concrete structure is shown in Figure 3.

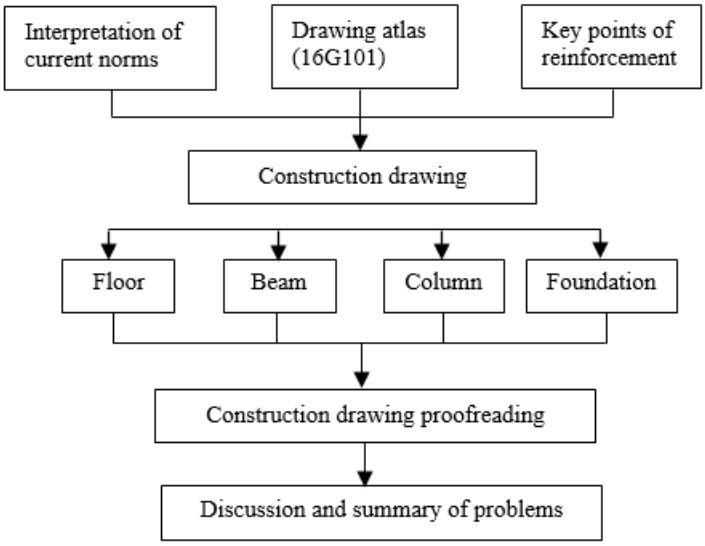

Fig. 3 content of construction drawing teaching based on structural measures

In the teaching process of construction drawing, we explain the rules and standard construction details of drawing atlas (16G101) and flat drawing rules and the corresponding standard design and construction requirements, using multimedia courseware and integrating practical teaching model of architectural engineering specialty as teaching carrier. Combined with the actual engineering project construction drawing standards, let students check their construction drawings, compare their drawings with the standard ones and find out the reasons for the difference.

Through repeated training to achieve the construction drawings in line with the requirements of the structure, and improve the students' ability to draw the construction drawings of the structure. Guide some of the more outstanding students in the secondary development platform of AutoCAD, using ActiveX Automation technology to adjust the construction drawings exported by PKPM software.

Combined with the actual project situation, it can more quickly and accurately edit the reinforcement construction drawing, so as to improve the working efficiency of the construction drawing, and improve the students' innovation ability.

3 Collusions

The teaching reform and practice of PKPM software with the idea of structural design forms a teaching model which emphasizes the knowledge and ability that is complementary to the theory and Practice Teaching. Through the structural concept design, structural optimization design, construction measures design three courses ability training module. Through three courses ability training module (the structural concept design, structural optimization design, construction measures design), the civil engineering students not only have the basic ability to use structural design software skillfully, but also have applied talents of structural engineering design ability.

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