Teaching research on Hull Structure and Grahping based on virtual simulation

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Abstract: Due to the lack of practical links such as cognition practice, the traditional teaching mode of Hull structure and drawing is difficult to help students establish 3D hull cognition. This course innovatively introduces case-book method and project teaching method. Students can learn 3D hull cognition and 2D drawing mapping by 3D virtual simulation model. Around the "learning knowledge drawing" to form a closed-loop task evaluation method, a virtual shipbuilding can be finished by students. This will improve professional recognition and industry pride.

1. Introduction

The promulgation of excellent engineer 2.0 is a major measure to move towards a powerful country in engineering education. New engineering and excellent engineers have put forward higher requirements for the current curriculum teaching in the field of engineering education.

Hull Structure and Graphing is the core course of Naval Architecture and Ocean Engineering, and it is also the first professional basic course for students of this major. It is a compulsory course for design and construction direction, structural mechanics direction and fluid mechanics direction. Its teaching content and teaching effect have a great impact on students' professional cognition and professional quality.

According to years of teaching summary, students are good at concept memory and software learning, but they are not good at practice development.

The traditional classroom teaching mode describes the hull structure through PPT and pictures, which compresses the 3D Hull into 2D pictures. Moreover, with the lack of practical links such as cognition practice, it is difficult for students to establish 3D hull characteristics. Therefore, although "Hull Structure and Graphing" is also the application of three view principle, students cannot connect the drawings with the actual structure. They can only complete the learning task by rote. As a result, students are lack of interest in major and enthusiasm for learning, which directly affects the follow course learning.

Aiming at the problems existing in Hull Structure and Graphing under the new situation, the teaching reform is carried out from the teaching methods and contents. On the premise of ensuring the teaching objectives, the students' three-dimensional ship cognition is solved, and the combination of theory and practice is deepened.

2. Reform

2.1 Training objectives

Through curriculum learning, students are required to meet the following requirements:

Understand the types and characteristics of ships; Be familiar with the structural form, name, layout and function of each part of the hull;

Be familiar with the standards of hull drawing;

Master the reading and drawing methods of hull drawing;

Master the mapping relationship between 3D Hull and 2D drawings, and be able to realize hull modeling according to hull drawings.

2.2 Teaching methods

Traditional classroom teaching methods focus on theory. In order to link theory with practice, the case-book method and project teaching method are introduced with practical engineering cases. 150 ton refrigerated vessels, 3000TEU container ships and 38 meters deep-sea fishing boat, which have been finished, are taken as cases to introduce ship types, ship structures and related drawings.Then the project can be decomposed and the students can complete the mapping modeling from the drawings to the 3D Hull. Through learning-reading-drawing, the course completes the closed loop of its own learning assessment.

2.3 Virtual simulation 3D Hull model library

By using the 3D design software, the 3D numerical ship model library is established for typical ships, such as bulk carrier, container ship, oil tanker and inland river ship. The detailed hull shape and hull structure are simulated. In the 3D modeling software, the 3D numerical ship model can be rotated at any angle, cut in any direction and any direction view, which can make students understand the ship, which will help to establish the thinking of 3D ship better and realize the equivalent practical effect under the 3D virtual hull technology.

The model library is only equipped with hull shape and some large structures, such as superstructure, deck machinery, etc. The modeling is mainly based on the lines plan of the previous stage. For large ships with large external curvature, the model can be built after inserting frame body plan. The model ensures the smooth curve of the outer plate and the accurate positioning of deck building and machinery. The following figure shows the 3D hull model of 3500TEU container ship,which is realized by a Rhino software proficient.

Now, more and more 3D models are added to the model library. Many of these models have become more and more accurate after several students have been perfected.On the one hand, it can deepen their own learning, on the other hand, it can lay a good foundation for the latecomers.This is in line with the training goal of learning for application.
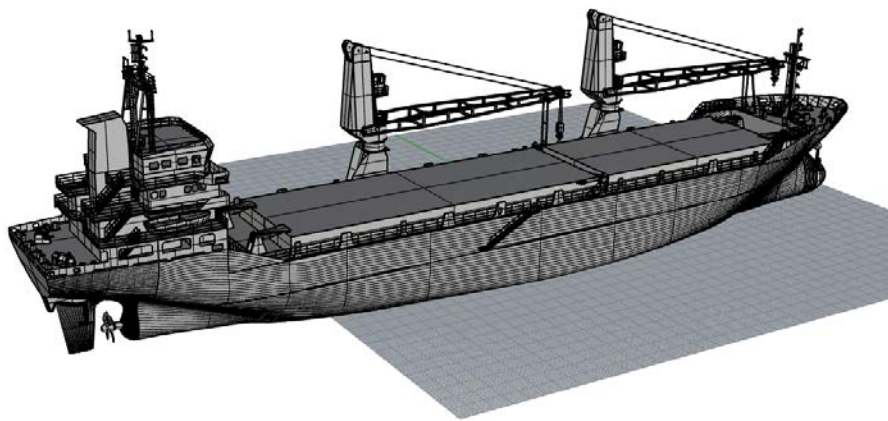

Figure 1. 3500TEU Container Ship

2.4 Mapping method between 2D drawing with 3D model

Hull drawing is the projection of 3D hull structure. By predefining the strength, visibility and projection rules of components, the corresponding relationship between different types of components and drawing lines is established. The 3D numerical ship model is mapped to 2D drawings by means of sectioning, rotation, and perspective, to realize the intuitive mapping between 3D Hull Structure and 2D drawings.

For example, the surface of hull is extracted according to the drawing of metal hull. Using the elevation projection method, different contour plane cutting surface is made to get the intersection line, and projection to three views. Keep the process of obtaining and projecting the intersection line, which can be used as an intuitive case for students to show. Finally, the section line projection is used to obtain the shape line and grid line to form the shape line diagram.
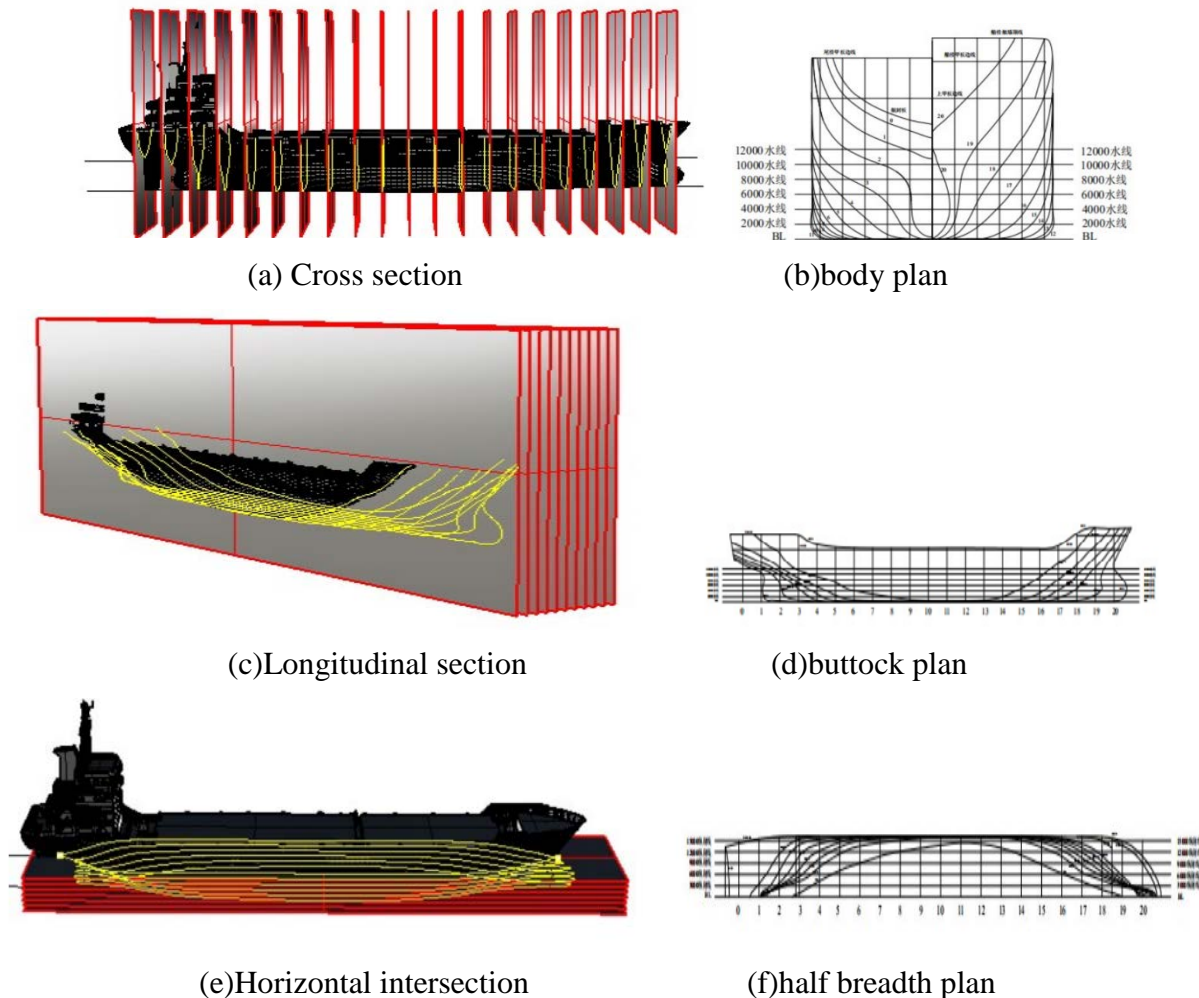

(a) Cross section

(b)body plan

(c)Longitudinal section

(d)buttock plan

(e)Horizontal intersection

(f)half breadth plan

Figure 2. Lines plan generation method for 3D model

3. Innovation

Traditional teaching is mainly instilling, and the examination is the main way. This mode causes students to learn for the examination and deviate from the purpose of teaching. The innovation of this course is to use the practical engineering case guidance and project teaching as the means to make students learn for practical use, learn from knowledge and use, with clear purpose and flipped learning status. And the evaluation of diversified teaching methods meets the requirements of accumulation, and creates an environment for students to study independently.

The difficulty of engineering drawing course lies in three-dimensional cognition and two-dimensional mapping, especially for ship engineering, which is not a common systematic engineering structure. This course innovates the three-dimensional virtual simulation model to replace the practical engineering, and establishes the intuitive three-dimensional ship cognition for students. The mapping of 2D drawings based on 3D model, such as projection, perspective, and section, is more intuitive. In the later stage, you can choose the appropriate platform for network sharing.

4. Conclusions

Based on the three-dimensional hull model of virtual simulation, through the introduction of case teaching method and project teaching method, the curriculum reform of hull structure and drawing has made great progress in integrating theory with practice. It is a great change for students to learn from the passive to the active.

Although virtual simulation is only a kind of three-dimensional modeling, it is an effective way to stimulate students' professional pride and industry mission. Taking group as a unit for 3D modeling can not only reduce students' drawing time, but also enhance students' team cooperation ability, so that students can really build a virtual ship in the school.

Acknowledgements

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