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Design and exploration of university fluid simulation course

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Abstract

With the development of the times, fluid simulation technology has been used in university courses. As many university courses are too theoretical and difficult to understand, in order to achieve better learning results, the author believes that visualizing abstract concepts with simulation tools can help promote the course and enable students to achieve ideal learning results. This course introduces CFD, a fluid simulation tool. Through learning this course, students can more deeply understand the principles of fluid mechanics and enhance their understanding and application ability of theoretical knowledge through simulation practice.

Keywords: CFD; Practice Teaching; Fluid Mechanics; Design and Exploration.

1. Introduction

Fluid mechanics technology are widely used in engineering and research in higher education. Fluid mechanics technology is characterized by a high degree of fundamental theory and abstract concepts. However, fluid mechanics is also practice-oriented and practical. In addition to this, fluid mechanics technology is closely related to different disciplines and focuses on the laws of fluid prohibition and motion. The discipline is very logical and therefore uses mathematical tools such as continuous functions and field theory. In general, the content of fluid mechanics belongs to the macro-mechanics branch of physics and has a clear practical character. [1] The physical scene of CFD simulation can be seen as a physical experiment conducted by computer. Compared with the traditional physical experiment, computer simulation is not subject to the model size, site, flow field disturbance, environment, funds, and other factors. On the contrary, its operation is more flexible. Computer simulation turns abstract concepts into images. It uses intuitive visual flow fields and animation videos to promote students' in-depth understanding of basic theories. Through the study of computer network, students' interest in learning can be stimulated and their logical thinking ability and innovation ability can be cultivated. [2][3]

2. Fluid simulation

Virtual simulation technology is a simulation technology that uses the computer system to simulate real equipment and systems. It is generated and developed due to the emergence of real-time rendering, allowing

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people to experience the interaction of various senses. [4] Its essence is a computer system that can create a virtual world and has a certain sense of experience. The unique interactivity, authenticity, real-time and imagination of virtual simulation can make the experiencer have a strong sense of immersion.

Fluid simulation provides us with new ideas for learning. The commonly used computational fluid dynamics (CFD) software includes ANSYS (FLUENT), COMSOL Multiphysics, CFX, PHOENICS, CD-STAR, FLOW3D, among which FLUENT is the most mature and widely used. [5]FLUENT software has rich and advanced physical models and powerful post-processing functions, such as laminar and turbulent flow, steady and unsteady flow, and inviscid flow. In numerical simulation of specific problems, we can select different models, calculation methods and discrete formats according to the specific situation to obtain the numerical solution. And then the calculation results can be displayed in images or animations.

3. Design and Exploration of Fluid Simulation

3.1 conceptual visualization

Computational fluid dynamics (CFD) is an analysis of systems that contain physical phenomena such as fluid flow and heat conduction through computer numerical calculations and image display. The CFD method and traditional theoretical analysis method, and the experimental measurement method constitute a complete system for studying fluid flow problems. Three-dimensional fluid mechanics is a schematic theoretical analysis method to characterize the relationship between them. Its advantage is that the results are universal, and various factors affecting clearly visible. Therefore, three-dimensional fluid dynamics is the theoretical basis for guiding experimental research and verifying new numerical calculation methods. However, it often requires the abstraction and simplification of computing objects, so that theoretical solutions can be obtained.

The experimental results obtained by the experimental measurement method are authentic and reliable. It is the basis of theoretical analysis and numerical methods, and its importance cannot be underestimated. However, experiments are often limited by model size, flow field disturbances, personal safety and measurement accuracy, and sometimes it may be difficult to obtain results through experiments. In addition, the experiment will encounter many difficulties, such as financial investment, huge cost of human resources, material resources and long cycle.

When students learn fluid mechanics, thermodynamics and other subjects that are theoretical, abstract and difficult to understand, they need to have a strong understanding ability. [6]Therefore, if students only carry out simple theoretical teaching according to textbooks, or combine slides to explain. In the course, it is impossible to be comprehensive and easy to be divorced from reality. As a result, students will feel monotonous and lose their interest in the subject. At this time, the course can use CFD simulation software. Use the software to show the complete process of CFD simulation, and then set up relevant experimental courses for students to experience. Through this method, not only expands the traditional multimedia teaching means, but also enriches the teaching mode and intuitively knowledge. It can also help students consolidate theoretical knowledge and cultivate their practical ability. In the course, through guide students cultivate CFD software is used to analyze the actual problems in basic skills. Let students have the ability to solve practical problems. And then through teaching practice to promote the teaching content. In order to effectively further stimulate

students' interest and initiative

3.2 Comprehensive expansion

Nowadays, as a branch of mechanics, fluid mechanics has been closely related to people's life and fully integrated into various fields. Such as ships, aerospace, sports equipment and other aspects, fluid mechanics has made great contributions.

The fluid mechanics of ship is the basic technology of ship science and the common technology of ship design. It not only provides rapid, refined, digital, practical advanced design, development technology and instrumental software for ship type design and development. It also improves the technical and economic performance of marine products, promote the upgrading of products to provide excellent ship type and sustainable development. Finally, it provides new ideas, new principles and new ideas for the research and development of new ship types. [7]In terms of space, cruise configuration airplane wings of geometric twist mainly improve the aerodynamic characteristics to consider.[8]

Fluid mechanics is magical and can explain many phenomena in life. Fluid mechanics opens the door to the fluid world, not only view some phenomena scientifically, but also to use fluid mechanics to optimize design. Through the combination of concrete examples, it is helpful to the study of theoretical knowledge. After laying a solid theoretical foundation, the theory can be better transformed into practical application in the future.

4. Conclusion

Fluid mechanics as a professional basic course, which involves many theoretical knowledge and a more abstract. Its formula is complex and the content is boring. Therefore, the simulation technology can make the knowledge come alive and visualize the concept. It can help students better understand and stimulate their innovation ability. Combined with students' specific learning situation, CFD numerical simulation can be used to assist in teaching complex or essential knowledge points. It can also show students the application of fluid mechanics in life to stimulate students' enthusiasm and initiative for further learning by using relevant simulation software. Through the course of a variety of examples of image, find the mystery of the fluid mechanics. For us to explore more helpful thing in life, give full play to students' subjective initiative, able to solve practical problems.

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