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Teaching Analysis of Hydraulic Transmission System Simulation Training Based on FluidSIM Software

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Abstract: *FluidSIM software is the key to carry out the simulation and training teaching of hydraulic transmission system. With the help of FluidSIM software, students can actively participate in the operation of hydraulic transmission system, so their learning interest and effect will be improved. In this thesis, the software of FluidSIM is analyzed, and the simulation training teaching of hydraulic transmission system in secondary vocational schools is further studied with the software of FluidSIM as the core, hoping to bring reference to people who pay attention to the simulation training teaching of traditional hydraulic system under the software of FluidSIM.*

Keywords: *FluidSIM software, Secondary vocational school, Hydraulic transmission system, Simulation training teaching*

1. Introduction

Hydraulic transmission system simulation training teaching is one of the important contents of port and shipping machinery specialty. In order to improve the quality of simulation training teaching, we should actively break the traditional teaching mode in the teaching process and realize all-round optimization of teaching links with the help of FluidSIM software. Using FluidSIM software to carry simulation training teaching can stimulate students' subjective initiative in the training course to a extent, and the learning quality will be significantly improved. Therefore, it is necessary to study the simulation and training teaching of hydraulic transmission system under FluidSIM software.

2. Overview of FluidSIM software

FluidSIM software is a teaching software developed by Festo company in Germany, which can greatly improve the teaching quality in hydraulic and pneumatic transmission. With the drawing and simulation functions in the software, it can effectively meet the needs of classroom teaching, and the drawing, the software can also automatically check the connection of various components. If the connection is not feasible during the inspection, it will lead to the failure of normal connection. the loop diagram of the physical model of the components can be simulated by the software of and the state diagram of the components will be displayed on the screen. After the simulation, the accuracy of the traditional hydraulic design can be verified and the demonstration of the loop action process can be realized. In addition, with the help of FluidSIM software, an electrical control circuit be designed to match the hydraulic circuit, so that students can understand the action of various on-off valves in the system while seeing the hydraulic circuit and combining with the electrical control circuit.

3. The purpose of hydraulic transmission system simulation training teaching

Hydraulic and pneumatic transmission is a comprehensive subject, and all kinds of knowledge in subject can often play a very important role in construction machinery, transportation and other industries. Because of the particularity of the subject, in order to improve students' understanding of knowledge points, it is necessary to carry out practical teaching on the basis of theoretical teaching. Consolidate students' knowledge system with practice as the core [1]. In the teaching of hydraulic transmission, teachers need to help students understand the schematic diagram of mechanical hydraulic system, and use what they have learned to analyze and solve related problems of hydraulic transmission system. Because the knowledge points of hydraulic transmission system are relatively abstract, and the components in it are very complicated, it is difficult for students to understand the knowledge points expounded by teachers at the first time when teaching with theory combined with practice. With the

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of FluidSIM software, students can understand the operation mode of hydraulic transmission system more intuitively, and then their understanding of knowledge points can be significantly improved.

Because of the material library of hydraulic components, FluidSIM software can realize simple and convenient rapid drawing. In the simulation practice teaching, the reasonable use of FluidSIM software can also realize the all-round simulation of the loop operation process, so that the fiction can master the working process of each component in the loop. As long as students can deepen their understanding of related components and loops, the overall learning quality of students can be guaranteed. During this period, with the help of FluidSIM software, the convenience simulation experiment of hydraulic circuit and control system can be realized. Even students can obtain different circuits by using different component combinations. Students actively participate in the circuit production, which can improve students' innovation ability and increase their classroom participation, thus ensuring the overall teaching quality of hydraulic transmission system.

4. Teaching design of hydraulic transmission system simulation training based on FluidSIM software.

In order to make the teaching content of simulation training designed by hydraulic transmission system meet the actual teaching needs, it is necessary to start with the basic content and deepen the difficulty of knowledge points to make students adapt to the whole teaching system. Therefore, with the help of FluidSIM software, teachers should not only simulate key knowledge points, but also conduct comprehensive teaching from basic components to complex circuits. Only by letting students master solid knowledge points from functional demonstration, principle, operation and other links can the teaching work of simulation be carried out more smoothly.

In the teaching design stage of simulation training, in order to improve students' knowledge of hydraulic transmission system, we should deepen students' understanding of basic knowledge from the perspectives of system composition and working process. Moreover, by helping students understand the basic operation mode of simulation software, the follow-up practice teaching can be carried out more smoothly. For example, when using FluidSIM software to help students analyze the schematic diagram of hydraulic system, we should combine simulation to help students deepen the analysis of the role of hydraulic control valve. As long as students can master the role, working process and state of hydraulic control valve in the circuit smoothly in the simulation practice teaching, they can greatly improve their understanding of hydraulic transmission system. At the same time, if students can further disperse their thinking under the same action, they can also readjust the component combination and electrical control program with the help of the basic operation method of software. Students can effectively stimulate their own learning motivation by independently designing different kinds of hydraulic circuits in simulation software, thus greatly improving the overall teaching quality of simulation practice teaching.

In the simulation practice teaching, the basic PLC control program can be set according to the working conditions, and the basic hydraulic and electrical components can be used to build a simple control loop in the program. Teachers can provide students with practical questions in the classroom, so as to improve students' participation in the classroom during the thinking process. This kind of thinking degree can give students greater freedom as far as possible, otherwise it will affect the divergence of students' personal thinking. In order to show flexibility, teachers can let students combine their own personal understanding and ideas to scientifically establish a control loop. As long as the results obtained by students have sufficient reasons and the design is reasonable, students can be affirmed in their grades. If the design reasons put forward by students are sufficient but difficult, teachers can also guide students to solve problems encountered, so as to improve the efficiency of classroom simulation practice teaching.

When using FluidSIM software to carry out simulation practice teaching activities, teachers should control the teaching time according to the class hours. Only by adhering to the educational concept of "from shallow to deep" in the teaching process can students' learning pressure in the traditional hydraulic system be minimized. It should be noted that, because the foundation of simulation practice teaching is FluidSIM software, the teaching time of software operation course must be appropriately relaxed. If one class hour can't help students to thoroughly master the necessary knowledge points such as component library materials and operation methods, an extra class hour should be added to meet students' learning demands. As long as students can effectively master the basic knowledge of software, simulation practice teaching will get twice the result with half the effort.

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5. Teaching strategy of hydraulic transmission system simulation training based on FluidSIM software

FluidSIM software is the core of the simulation training teaching of hydraulic transmission system. By analyzing the teaching from two dimensions: the application method of FluidSIM software and related cases, the advantages of FluidSIM software in the teaching process can be intuitively reflected, and then the FluidSIM software can play its due role in formal teaching activities.

5.1 Application Method of FluidSIM Software in Simulation Training

5.1.1 Application of FluidSIM Software in Circuit Drawing

The main interface of FluidSIM software is simple and clear, which can help students greatly reduce the learning difficulty. During the drawing of hydraulic circuit, you can click on the function menu according to the actual demand. In the function menu, there is a component library on the left and a design interface on the right. When drawing the schematic diagram, you can directly put various hydraulic system components into the drawing area from the component library on the left, and the components can move freely in the drawing area with the help of the mouse. Because of the flexibility of software operation, it can be adjusted at will, whether it is spring return or normal position of components. For the software operator, it is only necessary to put all components into the drawing area and connect them in actual operation, so that the system diagram can be simply drawn.

5.1.2 Application of FluidSIM software in hydraulic circuit simulation

After the hydraulic circuit drawing is finished, the FluidSIM software can be switched to the simulation mode for simulation processing. Before the simulation begins, the operator can set the parameters of various components on the hydraulic circuit diagram. Because the parameters of different components will directly affect the final simulation phenomenon, the parameters can be adjusted according to the requirements of the circuit, and students can fully understand the practical significance of various parameters in the circuit with the help of the simulation phenomenon. During the simulation process, the operation of the hydraulic circuit and the working state of each hydraulic component will be displayed in real time. Students will gradually become more and more profound about the hydraulic circuit and components through continuous research on the working process of each component.

5.1.3 Application of FluidSIM Software in Electrical Control Circuit

In the practical application of FluidSIM software, there are many electrical control components that can be freely selected. Whether it is the positive and negative poles of 24V power supply or other various switches, contacts and other components, they can be used to design an electrical control circuit that matches the hydraulic transmission circuit. By simulating the hydraulic transmission circuit and the electrical control circuit at the same time, students' mastery of the hydraulic transmission system can be further improved. Moreover, in the simulation training course, teachers can also use FluidSIM software to design classroom tasks for students, that is, students can freely combine electrical control components and hydraulic components with the knowledge they have learned, so as to design a scientific and reasonable hydraulic transmission circuit, and the feasibility of the circuit can also be analyzed with the help of simulation test [2]. For students, with the help of FluidSIM software, the problems encountered during loop design can be displayed intuitively.

5.2 FluidSIM software simulation training teaching analysis

Taking the "differential connection circuit" in the hydraulic transmission course of Class A in a secondary vocational school as an example, the specific methods of using FluidSIM software in simulation training teaching are as follows:

5.2.1 Demonstration of working principle of differential connection circuit

When the piston of the hydraulic cylinder does not touch the travel switch, the solenoid valve works in the middle position, and the oil output by the hydraulic pump will be communicated with the cavities on both sides of the hydraulic cylinder at the same time, and the hydraulic circuit is in a differential connection state. After the piston touches the travel switch, the solenoid valve will enter the left position, and the hydraulic cylinder will feed oil from the left cavity and return oil from the right cavity. After the piston rod touches the travel switch, the solenoid valve will enter the right position to work. After the hydraulic cylinder is extended, the slope of the displacement curve of the differential

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connection will be obviously larger than that of the non-differential connection, which means that the rodless cavity oil will be continuously increased without additional increase of the pump flow, which will also accelerate the piston's movement to the right. Fig. 1 is a differential connection circuit.

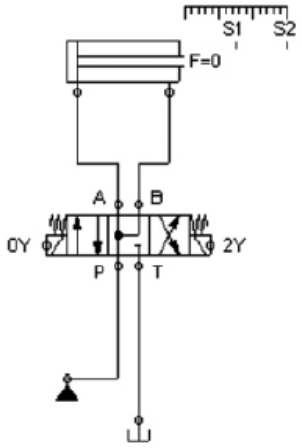

Figure 1 Differential connection circuit

5.2.2 Guide students to build differential connection circuits.

After providing students with the working principle of differential connection circuit, teachers need to combine the requirements of working conditions to let students complete the construction of differential connection circuit through FluidSIM software. The action of hydraulic cylinder under stroke control is fast forward, working in and fast backward, and the working in and fast backward can be realized by using speed loop and reversing valve respectively. Moreover, using the travel switch to control the electromagnetic reversing valve can also realize high-speed switching. Students can distinguish the running sequence of electromagnets by combining the system schematic diagram and the action of hydraulic cylinder. At this time, combining the basic knowledge of PLC they have learned, they can realize programming with the help of FluidSIM software.

Combined with the actual requirements of PLC program, we can find out the related electrical components. By using the travel switch to carry out hydraulic cylinder action and carry out simulation debugging, we can effectively detect whether the system can meet the working conditions. When arranging students for simulation operation, teachers should play a guiding role in the whole process. By giving students enough freedom, they can satisfy their creative will. When the students finish the classroom tasks independently, they can also put forward the simulation ideas and schemes by themselves and use simulation debugging to verify the operation. By recording all their operations in the classroom in the report, teachers can give daily classroom results through the students' learning situation.

In the simulation training classroom, teachers can also put forward relevant thinking questions according to the classroom content, and combine the actual situation of students to carry out targeted teaching. For example, in the course of differential connection circuit, students can define the working conditions in advance and be free to design circuits that can meet the requirements of working conditions. By constantly using students' brains in thinking questions, students' ability to master the knowledge points of the course can be greatly improved. Because there are differences in students' learning ability in the classroom, we can also put forward thinking questions with different difficulties for different students by combining the concept of hierarchical teaching appropriately, and students can choose suitable thinking questions to choose and do. As long as students' desire to solve problems can be stimulated by thinking questions, the teaching quality of the course can be greatly improved.

5.2.3 Teaching Effect of Simulation Training of FluidSIM Software

With the help of FluidSIM software, the students of Class A differential connection circuit course in this school have successfully deepened their impression of classroom knowledge. Compared with other courses that do not use FluidSIM software, the students' ability to master knowledge points in differential connection circuit course is obviously higher. Therefore, FluidSIM software can play a very significant role in the simulation training teaching of traditional hydraulic system. Moreover, because of the strong functionality of FluidSIM software, teachers can also make the integration of classroom

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theoretical knowledge and practical knowledge better. By stimulating students' classroom learning drive, students can master knowledge in practice, which can effectively meet students' actual learning needs and greatly improve students' understanding ability of traditional hydraulic system. As far as teachers are concerned, as long as they can use FluidSIM software flexibly in the classroom, the classroom atmosphere and teaching effect can be guaranteed.

6. Conclusion

In a word, FluidSIM software is the core of the simulation training teaching of hydraulic transmission system. By analyzing the application of FluidSIM software in the training simulation teaching, the teaching quality of traditional hydraulic system can be greatly improved. It is believed that as more people realize the advantages of FluidSIM software in the teaching of hydraulic transmission system, the simulation training teaching based on FluidSIM software will become more perfect.

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