Mechanical Virtual Experiment Based on Flash Technology

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Abstract. Virtual experiment teaching platform can effectively solve the problem of insufficient funding experiments. Articles can be developed advanced complexity equipment through the virtual platform, to allow students a deep understanding of the image of the device body movement principle, to acquire knowledge itself; the other hand, the platform is a good solution to student learning in time and space on limitations. This paper analyzes the development of virtual experiment at home and abroad, through the comparison of various learning theories and studies comparing various virtual reality technologies, the characteristics for the mechanical discipline. The paper developed a mechanical virtual experimental teaching platform based on Flash technology, the device will integrated techniques of self-observation, self-disassembly, self-planning connection, 3D simulation, automatic calculation of the corresponding motion analysis in one, with a visual, interactive, scalable, and many other advantages that can be developed .

Keywords: experimental teaching, virtual experiment, Flash technology.

1 Introduction

The development of modern educational technology in teaching computer virtual experiment is widely applied [1-3], especially in some universities As the school resulted in the rapid expansion of the scale of the corresponding matching funds can not be put in place, there has been lack of practice teaching conditions and aging equipment update inconvenience and other problems face reduced funding for colleges and universities, to improve the quality of teaching and other policies, the traditional experimental teaching model has been a huge challenge, then the virtual experiment teaching has become a good choice. present our virtual experiment in teaching the study also a certain lack of systematic and good humanized design [4-7], and the development of virtual experiment experimental teachers in general there is a certain degree of difficulty in the virtual experiment progresses, the virtual instrument for the experimenter to correct all operations the response and the experimenter to get exactly the same manner as the actual experimental experience, is to build the core virtual experiments, even more important is the content according to the specific virtual experiments select the appropriate construction techniques [8-12]. article experimental teaching of mechanical prototype, using Flash technology for the design platform, combined with Pro/E, AutoCAD and other machinery commonly used software, the

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use of modern educational technology, design and develop a virtual experiment in which five machines.

2 Design and Development of Virtual Experiment

Article takes virtual simulation technology into teaching, mainly tries to develop the institutions and agencies of cognitive experiments [13, 14], Kinematic Diagram experiment, and four kinematic principle experiment, involutes gear experimental and statistical analysis of experimental machining errors, certain extent, solve the problem of insufficient laboratory equipment, but also to improve the student's positive initiative, and achieved good teaching effect. experimental system developed by the design of the general structure is shown in Figure 1, to help some of the major shows the experimental system operating environment and software use, the significance of the relevant interface and buttons, etc.; experimental guidance section describes the purpose of the experiment, principles, methods, procedures, experimental significance, and provide test report single download; experimental part is the main part of virtual experiments, according to experimental purposes and requirements of completion of the relevant experiments; data analysis part is a relatively large amount of data for some experiments designed to further experimental research or for teachers on student test report marking convenience.

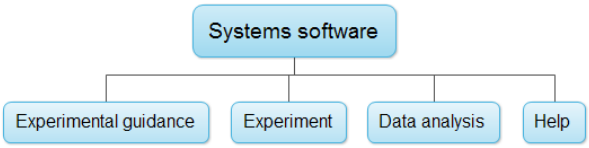

Fig. 1. The general structure of system software

2.1 Mechanism and the Mechanism of Cognitive Experiments

Institutions and cognition are commonly observed planar linkage, spatial linkage, cam, gear, gear train, intermittent motion mechanism and the combination type of institution and movement [15-18]. Bodies, machines, exercise deputy member has a certain understanding for us, and the basic elements of the machine have a preliminary understanding to students. Traditional experimental methods are generally visited mechanical teach showcase to complete, but the limitations of teaching and updating showcase growing problem show.

Experimental Center through Pro / E, UG, AutoCAD and other software on the part of institutions to establish a three-dimensional model, through Flash technology for the design platform, the use of XML, Web and other technologies, the development of institutions and agencies cognitive experimental system, which from the multi-angle shows the structural characteristics of institutions or movement characteristics, the system can be realized with a link to an external file system to facilitate the achievement of institutional repositories expand or update Figure 2 (left) selection screen for the organization of cognitive model experimental system, click on the selected picture the agency will enter a three-dimensional

display interface; Figure 2 (right) is the use of Pro/E assembly exploded diagram created in the system, which can see the assembly of the agencies teach animation, a clear understanding of body assembly process, enabling organizations consisting of cognitive, reaching experimental teaching purposes.

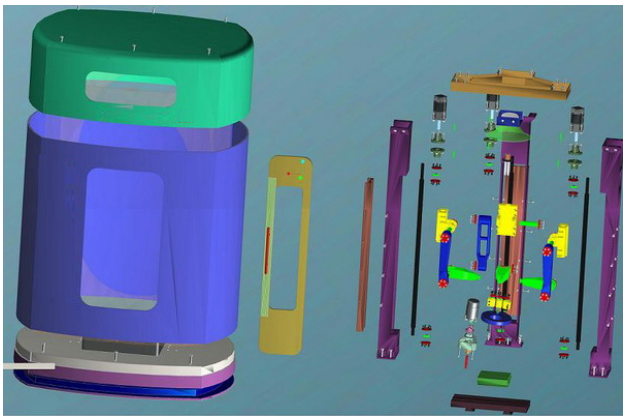

Fig. 2. Mechanism and experimental system

2.2 The Motion Diagram of Mechanism

Experiments require students to be familiar mechanism motion mapping methods, master mapping agencies for the actual mechanism motion map skills [19-23]. Experiment with how kinematic mechanical structure diagram and the difference between the actual and further deepen our understanding of body composition principle, Student can calculate the degree of freedom and their meanings.

Fig. 3. Mechanism of and mapping experiment system

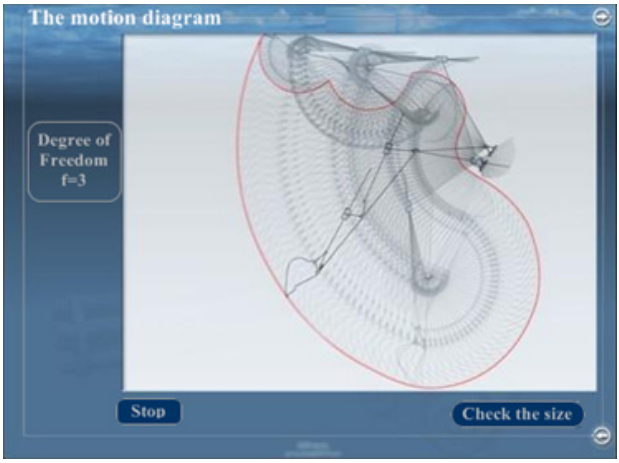

Fig. 4. The excavator arm movement

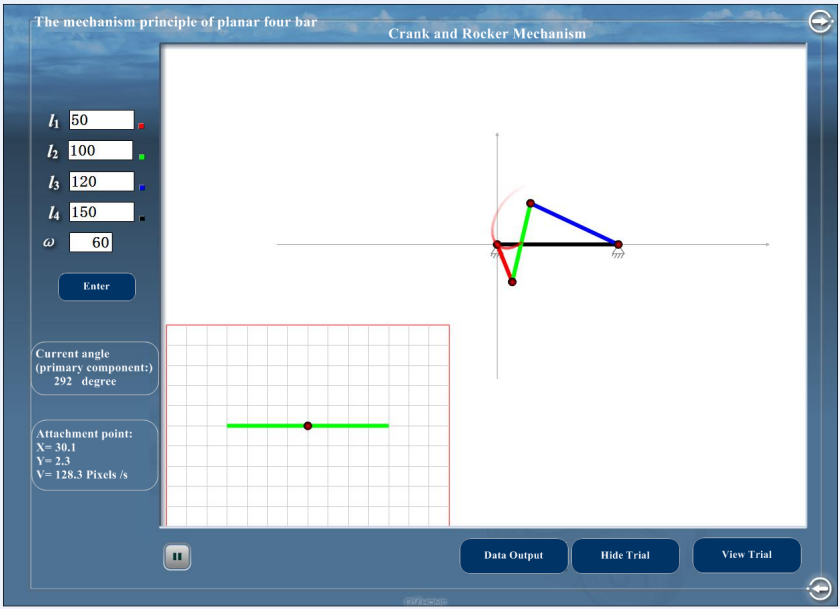

Fig. 5. Different design parameters into gear after the overall comparison

Developed mapping system kinematic diagrams, frameworks and institutions and agencies cognitive experimental system is similar, but we adds mapping and reference results through password access and many other features. Figure 3 shows the system during the measurement, the measured value will be displayed in the left panel; Figure 4 shows a schematic diagram of the excavator arm movement, body movement through dynamic diagram, play with the gradual control, clearly show the significance of the degree of freedom, and enhance the understanding of kinematic diagrams, to experimental teaching purposes.

2.3 Experiment of Four Bar Kinematic Principle

Four mechanism motion experiments are to enable students to master institution and its law of motion under different conditions of the formation for a long rod type. the development of mechanism motion principle experiment system achieve a body movement accurate simulation, according to different rod lengths automatically determine the four types of institutions according to their law of motion exercise, can dynamically adjust the speed and direction of movement of bodies (enter a negative movement in the opposite direction), you can display any link and its vicinity point trajectory, velocity and acceleration of the four institutions trajectory study has important significance.

2.4 Involutes Gear Experiment

Involutes gear experimental system can overcome the lack of the traditional mechanical meter range. We can energy intuitive, dynamic simulation of gear machining situation and to demonstrate the gear design parameters for involutes tooth profile curve, in order to better achieve the experimental teaching purposes. the experimental system can achieve different design parameters tooth profile comparison, either during the process or in the tooth profile of the comparison process, accessible by clicking the left mouse button, and with the middle mouse button wheel to achieve gear pan and zoom, easy to achieve timely content viewport observed more clearly show the shape of the various

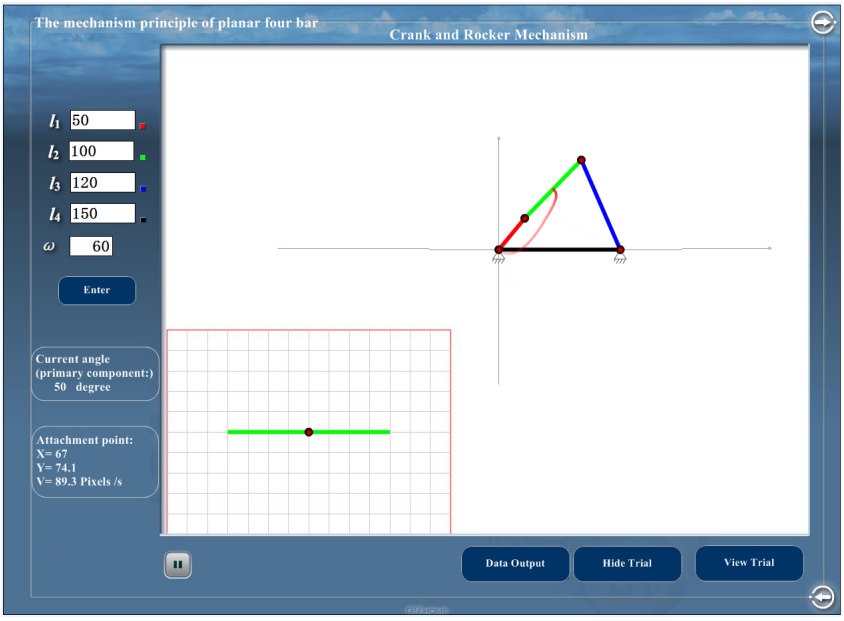

Fig. 6. A common geometric parameters of the gear

parts of the tooth profile Figure 5 range for different design parameters into gear after the overall comparison; Figure 6 is determined by visual mouth scaling function displays the shape of tooth profile can clearly see which undercut phenomenon, when the mouse pointer on the appropriate gear will show a common geometric parameters of the gear.

2.5 Statistical Analysis of Experimental Machining Error

Statistical analysis is done by a number of workpiece machining error manifestation to study the cause of error method. Machining error statistical analysis of experimental aims to consolidate the already learned the basic theory of statistical analysis, master the use of statistical analysis method steps. Through this experiment, students are required to master the actual size of the workpiece drawing maps of the method, and according to the distribution analysis of the nature of the error processing, computing process capability factor, rate of qualified products and scrap rates, etc., can put forward process improvement measures; master drawing XR dot pattern method, according to the process XR point of the stability diagram. Figure 7 sample data for the distribution obtained after the treatment, with a combined error statistics for the normal case; Figure 8 graphics for the point, when the points beyond the control line, that will be a special display, move the mouse to each point, the point will be able to display the relevant information.

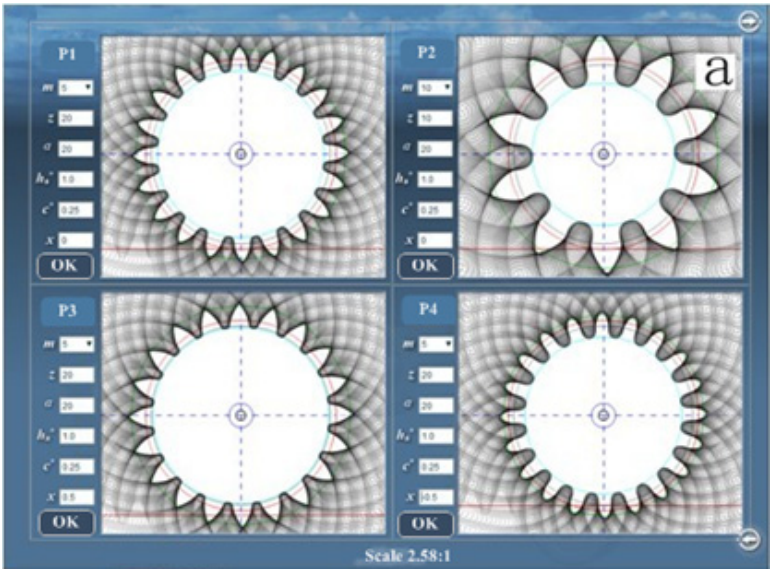

Fig. 7. Tooth profile Comparator Interface

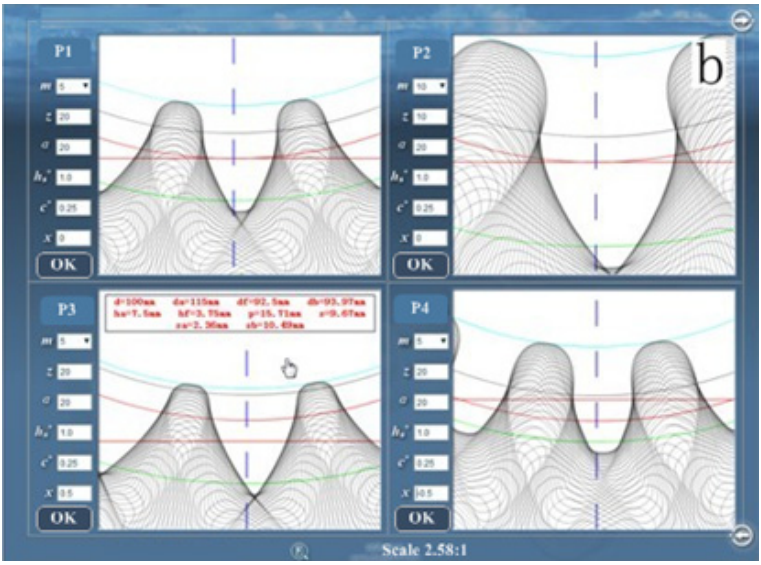

Fig. 7. (*Continued.*)

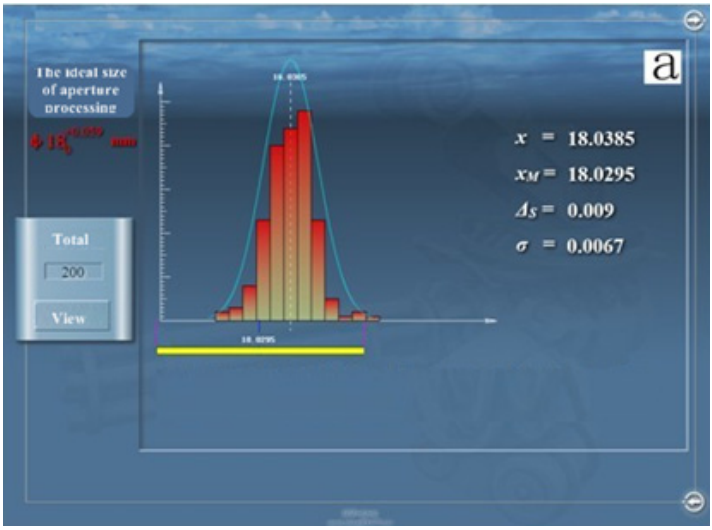

Fig. 8. Results of data processing

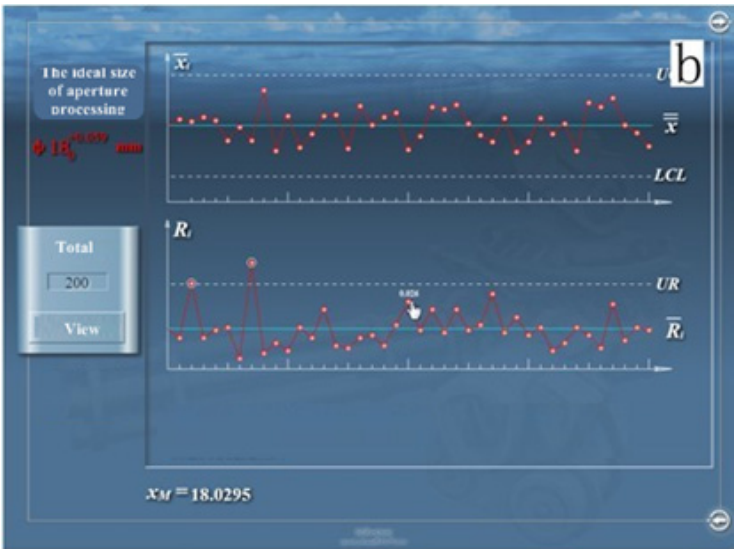

Fig. 8. (*Continued.*)

3 The Construction of Virtual Laboratory

Virtual Experiment Center create virtual experiments, carried out experimental teaching network, that can enrich the learning resources, alleviate the lack of equipment, but also reflects the personalized learning environment, improve teaching model, to improve teaching effectiveness. According to existing laboratories and experimental development project information, initial ideas mechanical engineering virtual laboratory structure is shown in Figure 9. Main function is to display institutions, virtual simulation and performance testing, along with the deepening of the reform of experimental teaching; experimental type and quantity will gradually increase, eventually forming the perfect virtual experiment teaching system.

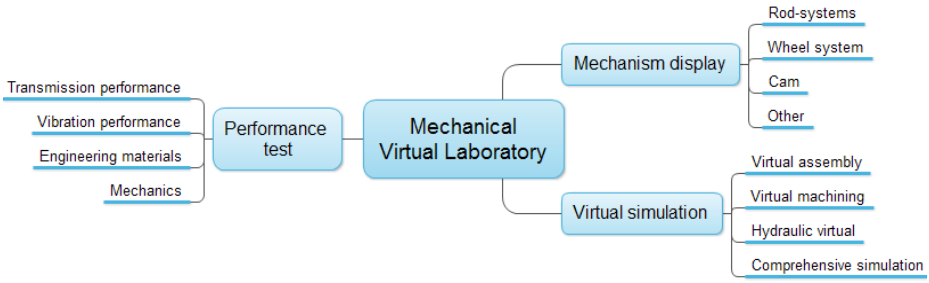

Fig. 9. The structure of Virtual Laboratory

4 Conclusions

Virtual experiments overcome the shortcomings of traditional test, which has become a powerful supplement traditional experimental teaching. Virtual experiment teaching enhances students' interest in experiment, reducing the cost of experiments, the overall teaching better. And virtual experiment software with small, high quality, fast speed, and easy operation, with a strong portability, interactivity and simulation is very suitable online learning based on flash technology.

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