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THE USE OF INFORMATION AND EDUCATIONAL RESOURCES IN THE EDUCATIONAL PROCESS

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ABSTRACT

Currently, the training of specialists in credit technology, according to which students are taught at the University, determines the relevance of developing new conceptual foundations in the organization of educational and methodological work and the introduction of modern, information and communication technologies in the educational process. The above suggests the widespread use of information technology and personal computers to simulate various physical processes, both in the learning process and current control. The use of computers activates the process of studying the discipline by students, facilitates and accelerates the assimilation of new material and control, which ultimately improves the quality of education and deepens students' knowledge. Therefore, the study of methods for modeling physical processes using modern application packages is currently the most relevant.

In the article, for a visual representation of physical processes using the MathCad program, modeling of complex systems described by ordinary differential equations of the second order is given. Using this Mathcad package, a graph of forced oscillations without resistance in the presence of an external periodic force is obtained using the odesolve function. The paper also talks about the use of physical models in the educational process.

Key words: Physical processes, Mathcad, modeling, physical models, Runge-Kutta method, complex systems, solutions of ordinary differential equations, learning process, examples of problem solving.

Introduction. Currently, in the conditions of credit technology, pluriactivity, the availability of textbooks saturated with theory, the shortage of classroom time, new approaches to the design and implementation of physics training are needed to achieve high quality knowledge and skills. At the same time, both standard programs and those developed at departments are used when studying the most important topics of the theoretical course and the material of practical and laboratory classes.[1]

Training systems created with the use of computer technologies belong to a specific type of technical means of training and are designed to facilitate the work of the teacher and free him from laborious work.

The use of computers is associated with the solution of a number of problems of the development of physical education. Automated training systems can be used as a supplement and explanation of the lecture course, for the current control of knowledge in practical classes, as well as for the automation of laboratory work.

The purpose of the work. Laboratory classes (practicum) for a number of specialties are one of the leading forms of work. The main purpose of the workshop is to experimentally confirm the theoretical provisions of the studied science, to ensure that students understand the basic laws and forms of their manifestation, to form a professional approach to scientific research among future specialists, and finally, to instill skills of experimental activity.

The increase of creative potential and professional skills is carried out in full only with the practical application of knowledge. The laboratory workshop promotes students' knowledge of the organic unity of theory and practice, introduces them to the directions of development of experimental science, develops interest in research and independent creative work.

Computer training systems can be widely used at all stages of laboratory classes: experiment planning, data processing and analysis, registration of research results. If the computer

is not the object of study itself, then its role is reduced to providing work.[2]

One of the most unique features of electronic technology is computer modeling of physical processes. At the same time, a program simulating a physical experiment should be considered as part of a whole complex of closely interacting training programs.

The computer is equipped with means of visualizing the results, that is, it makes it possible to present the solution of the problem in a visual dynamic form (on a graphical display), to observe its dependence on the parameters. All this makes it possible to bring the numerical experiment closer to the natural experience. Working with such a model is interesting and teaches students to "feel" the nature of the most important equations of physics, develops intuition.

Research methods. Computer laboratory work began to be created in the nineties of the last century due to the advent of cheap microcomputers, the development of a dialog mode of working with a machine, machine graphics and animation. The scientific basis of such educational works is the methods of machine modeling, which have greatly changed physics and led to the emergence of a whole new branch of science - computational physics. "Virtual" laboratory work is an educational computer experiment that has the right to coexist with a natural physical experiment conducted in the same way in real conditions.

The objectives of the laboratory practicum are an in-depth study of theoretical material, familiarity with the methods of measuring various physical quantities, the formation of experimental work skills among students, etc. Laboratory experiments are actively and relatively independently performed work: after getting acquainted with the theory, the student himself, under the guidance of a teacher, takes measurements of the necessary physical quantities, processes measurement results, builds graphs and works with them and, finally, independently draws conclusions based on the results of his work. Thus, the laboratory practicum contributes to the formation of students' research skills.[3]

There are a large number of examples of physical phenomena and processes for which models of varying degrees of realism can be built, and from all branches of physics. It is important to emphasize that, using computer modeling, it is possible and necessary to use the huge potential of opportunities provided by modern technology and application programs when studying various sections of physics.

The use of specialized packages for mathematical calculations presented on the market of applied software is becoming increasingly widespread in laboratory workshops on the course "Numerical methods". Of all the variety of such packages, we prefer the Mathcad package, as the most adapted from our point of view for the educational process. [4].

The Mathcad system has the ability to solve partial differential equations and their systems. Mathcad tools allow you to solve one-dimensional parabolic and hyperbolic equations (with one spatial and one temporal variable). Such a seemingly narrow range of solved problems actually covers the vast majority of problems arising in physics and engineering.

This paper shows methods for solving ordinary differential equations in the Mathcad package based on numerical methods for modeling oscillatory physical processes. As an example of solving higher-order differential equations using the odesolve function of the Mathcad package, a graph of forced oscillations without resistance in the presence of an external periodic force is obtained.

The solution of a higher-order differential equation is given using the odesolve (t,b), function, where t is a variable, a, b- the end point of the integration segment. A graph of the resulting solution is also plotted (parameter values are taken for certainty $q=a=\omega=1$, and the initial conditions are given in the form $y(0)=0, y'(0)=-1$).[5]

From mechanics we know that forced oscillations are described by the following equation:

$$m\frac{d^2\psi}{dt^2}+b\frac{d\psi}{dt}+k\psi=F_0\cdot\sin(\omega t) \quad \text{или}$$

$$\frac{d^2\psi}{dt^2}+2\beta\frac{d\psi}{dt}+w^2\psi=f\cdot\sin(wt),$$

где $\frac{b}{2m} = \beta, \frac{k}{m} = w^2, \frac{F_0}{m} = f$.

Given

a := 1 q := 0.1 w := 1

$y''(t) + q \cdot y'(t) + 1\, y(t) = a \cdot \sin(w \cdot t)$

y(0) = 0 y'(0) = 1

t := 0, 0.2 .. 100

y := Odesolve (t, 50)

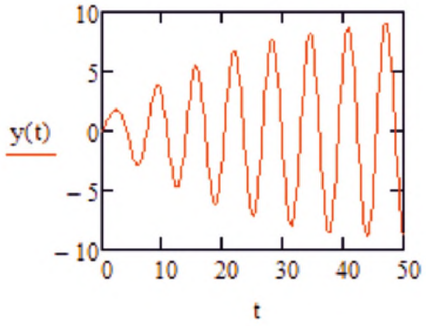

Figure 1 – Forced oscillations without resistance in the presence of an external periodic force

The main results. As a result of these modeling works, the user receives a ready-made model of the system and has the opportunity only to arbitrarily set the initial conditions and control all the parameters of the model during the numerical experiment. In this development, the tasks were set: to facilitate students' understanding of the basic physical laws, their logical and causal relationships; to help understand the relationship of various physical characteristics, to establish a correspondence between the natural behavior of the object, analytical dependencies and their graphical representation. The user is provided with an environment with the possibilities of free manipulation of mathematical models of physical objects, processes and effects. Trainees can handle models of elementary objects as design material, creating models of complex systems, not only perform laboratory work using ready-made schemes, but also design new schemes from ready-made models, and even modify models. By establishing information links between elements, understanding the principles of their interaction, observing the reaction of the system to external influences, working out the methodology for managing complex systems, the user organically combines the study of physics with the study of computer science. Moreover, it is important that computer science acquires a truly applied character in the eyes of students. [6]

Conclusion (conclusions). Thus, the use of computer technology makes it possible to obtain the consequences contained in theoretical propositions, compare them with the results of experience and correct the original model. As a representation of a real system, and in order to master modeling skills, an algorithm has been developed and a program for solving the differential equation of elastic vibrations without resistance in the presence of an external force has been compiled. Also, the user is given the opportunity, based on the developed models for various fields of physics, to carry out not only demonstration, but also research and design work on the principles of mathematical modeling, which allows organizing the creation, testing and fine–tuning of new systems - mechanisms, devices and other technical devices.

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ИСПОЛЬЗОВАНИЕ ИНФОРМАЦИОННО-ОБРАЗОВАТЕЛЬНЫХ РЕСУРСОВ В УЧЕБНОМ ПРОЦЕССЕ

Аннотация. В настоящее время подготовка специалистов по кредитной технологии, по которой проводится обучение студентов в Вузе, обуславливает актуальность разработки новых концептуальных основ в организации учебно-методической работы и внедрения современных, информационно-коммуникативных технологий в учебный процесс. Сказанное предполагает широкое использование информационных технологий и персональных компьютеров, для моделирования различных физических процессов, как в процессе обучения, так и текущего контроля. Применение компьютеров активизирует процесс изучения дисциплины студентами, облегчает и ускоряет усвоение нового материала и контроль, что в итоге повышает качество обучения и углубляет знания студентов. Поэтому изучение методов моделирования физических процессов с помощью современных прикладных пакетов в настоящее время является наиболее актуальным.

В статье для наглядного представления физических процессов с помощью программы MathCad приведено моделирование сложных систем, описываемых обыкновенными дифференциальными уравнениями второго порядка. Используя данный пакет Mathcad, получен график вынужденных колебаний без сопротивления при наличии внешней периодической силы с помощью функции odesolve. В работе также говорится об использовании физических моделей в учебном процессе.

Ключевые слова: Физические процессы, Mathcad, моделирование, физические модели, метод Рунге-Кутты, сложные системы, решения обыкновенных дифференциальных уравнений, процесс обучения, примеры решения задач.

ОҚУ ПРОЦЕСІНДЕ АҚПАРАТТЫҚ-БІЛІМ БЕРУ РЕСУРСТАРЫН ПАЙДАЛАНУ

Түйіндеме. Қазіргі уақытта ЖОО-да студенттерді оқыту барысында кредиттік технология бойынша мамандарды даярлау, оқу-әдістемелік жұмысты ұйымдастыруда және оқу процесіне заманауи, ақпараттық-коммуникативтік технологияларды енгізуде жаңа тұжырымдамалық негіздерді әзірлеудің өзектілігін негіздейді. Жоғарыда айтылғандар оқу процесінде де, ағымдағы бақылау кезінде де әртүрлі физикалық процестерді модельдеу үшін ақпараттық технологиялар мен дербес компьютерлерді кеңінен қолдануды қамтиды. Компьютерлерді қолдану студенттердің пәнді оқу процесін белсендіреді, жаңа материалды игеруді және бақылауды жеңілдетеді және жылдамдатады, нәтижесінде оқу сапасын арттырады және студенттердің білімін тереңдетеді. Сондықтан қазіргі заманғы қолданбалы пакеттерді қолдана отырып, физикалық процестерді модельдеу әдістерін зерттеу қазіргі уақытта ең өзекті мәселе болып табылады.

Mathcad бағдарламасын қолдана отырып, физикалық процестерді көрнекі түрде көрсетуге арналған мақалада қарапайым екінші ретті дифференциалдық теңдеулермен сипатталған күрделі жүйелерді модельдеу келтірілген. Осы Mathcad пакетін қолданып, odesolve функциясы арқылы сыртқы периодтық күш түсірілген кездегі кедергісіз мәжбүрлі тербелістердің графигі алынды. Сондай-ақ, жұмыста оқу процесінде физикалық модельдерді қолдану туралы айтылады.

Түйінді сөздер: физикалық процестер, Mathcad, моделдеу, физикалық модельдер, Рунге-Кутта әдісі, күрделі жүйелер, қарапайым дифференциалдық тендеулерді шешу, оқу процесі, есептерді шешудің мысалдары.

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