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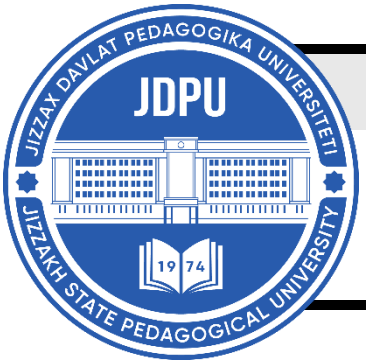

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USING MAPLE SOFTWARE IN MATHEMATICAL MODELING

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ABOUT ARTICLE

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Abstract: This article talks about the capabilities of one of the mathematical programs, Maple, its place and role in the educational process. Maple application software makes it easy to solve complex mathematical problems. The use of the Maple program in the educational process ensures an increase in the fundamentals of mathematical and technical education. Improves students' skills of applying theoretical knowledge to practice. Mathematical modeling on a personal computer using Maple is designed to teach problem solving. Assignments and exercises given as mathematical examples, practical problems and practical tasks can be completed without difficulty. In general, it is possible to find a quick and high-quality positive solution to problems suitable for applied mathematics programs intended for students of engineering and construction engineering.

INTRODUCTION

The rapid development of computer technologies, the emergence of a number of mathematical packages require changes in the structure and study of mathematics courses in schools and universities. Modern mathematics is currently using computer technologies to solve complex problems based on the requirements of the time. In this case, special mathematical programs come to

the rescue. Therefore, mastering the skills to develop and use such software is an important task. Using such packages increases interest in mathematics and makes it easier to solve more complex problems. Of course, this requires additional efforts from teachers, but these efforts pay off in the context of reduced math hours and when students have to master a large amount of material on their own. This issue is especially relevant in higher education. Nowadays, graduates of higher education are faced with the problem of using modern information technologies. This problem is particularly evident when using computer mathematics systems. Examples of such mathematical software packages include Mathcad, MATLAB, Mathematica, Maple, and others.

MATERIALS AND METHODS

Nowadays, it is difficult to imagine any industry without modern information technologies. Therefore, knowledge of modern information technologies is very important in terms of competitiveness and relevance for graduates of higher education. Mathematics is a powerful tool in solving various problems, if you use it correctly, you can get the desired results. The use of modern information technology only increases its power. Recently, many articles have been published about the use of computer mathematical systems, especially the maple program [5-8].

Mathematical modeling on a personal computer using Maple is designed to teach problem solving. Assignments and exercises given as mathematical examples, practical problems and practical assignments correspond to the applied mathematics course programs of the higher educational institution "Applied Mathematics" and other engineering, design and construction specializations. Engineering students often have difficulty understanding the theoretical part of the problem. For example, many mistakes are made in finding the general solution of differential equations or in drawing its gradient. In such situations, Maple comes in handy. When working with the program, it is necessary to pay attention to two important aspects, that is, the first is the theoretical part - the theoretical part contains a description of the studied Maple commands; the second is the aspect of working with practical tasks - a step-by-step detailed description of the operation of Maple commands using specific mathematical examples, that is, these tasks are intended to be performed by students under the guidance of the teacher.

The Maple environment was created in 1980 by Waterloo, Inc. (Canada). Today it has the following versions: Maple 5, Maple 6, Maple 7 and hokoza.

Schemes form the basis of working with symbolic expressions in Maple. It consists of hundreds of basic functions and algorithms of symbolic expressions. At the same time, it consists of a basic library of operators, commands and functions.

In total, Maple 5 has 2,500 functions, Maple 6 has 2,700, and Maple 7 has about 3,000 functions. This means that many issues can be solved through direct communication with the system[1-5].

Maple has the ability to solve a large number of problems without programming. All you need to do is write a problem-solving algorithm and break it down into several parts. In addition, there are thousands of problems solved in the form of solving algorithms, functions and system commands. Maple has three separate languages: input, solution, and programming. Maple is an integrated programming system designed for studying mathematical and engineering-technical calculations. It is a powerful system for working with formulas, numbers, text and graphics.

The program is very easy to use. Its interface is made so convenient that the user works with the program window like a sheet of paper. He writes numbers, formulas, mathematical expressions and jokes on it.

The Maple system has a text editor, a powerful computing and graphics processor.

A text editor is used to enter and edit texts. Texts consist of comments, and mathematical expressions included in them are not executed. Text can consist of words, mathematical expressions and formulas, special characters and symbols. The main feature of Maple is the use of commonly accepted symbols in mathematics.

Maple's computational processor has a wide range of capabilities. It performs calculations based on complex mathematical formulas. In addition to having many mathematical functions, the ability to calculate series, sum, multiplication, derivative and exact integrals, work with complex numbers, and solve linear and non-linear equations, perform operations on vectors and matrices creates.

The graphics processor is used to create graphics and display it on the screen. The graphic processor provides the user with the most convenient and simple options of graphic tools. The user can graph simple functions right from the start. Polar graphs, spatial graphs, vector field graphs, and histograms can be created along with traditional graphs. The graph is intended for solving typical mathematical problems. At the same time, it is possible to change the graphic often, add text notes to them, and move it to any place in the document. By placing text, graphics, and mathematical calculations in a single workspace, Maple makes even the most complex calculations easy to understand[9-13].

RESULT AND DISCUSSION

Today, the Maple program provides many opportunities for students to learn differential equations. In particular, in higher education, in the process of solving examples of differential equations and drawing graphs, it becomes difficult, and working with the Maple program creates many innovations and conveniences for students.

We will look at how to solve differential equations using the Maple program on a computer. To solve an ordinary differential equation analytically in Maple, the command dsolve (eq,var,options) is

used, where eq-equation, var-unknown function, options are parameters. For example, the equation y y x ′′+ =is written in the form diff(y(x), x$2)+y(x)=x. A general solution of an ordinary differential equation involves constants, for example, the equations may have two constants. Variables are defined in Maple as _C1, _C2.

It is known that the linear ordinary differential equation is homogeneous (the right-hand side is 0) and non-homogeneous (the right-hand side is not 0). The solution of an inhomogeneous equation consists of the sum of the general solution of the corresponding inhomogeneous equation and the particular solutions of the inhomogeneous equation. In Maple, the solution of an ordinary differential equation is given in the following form, that is, the part containing the constants is the general solution of the homogeneous equation, and the part without the constant number is the particular solution of the non-homogeneous equation . The solution given by the dsolve command is given in a non-computable format. To work with the solution in the future, for example, to draw a graph, it is necessary to separate its right side with the rhs(%) command. Now let's look at solving some differential equations in Maple.

A particular solution to a system of differential equations or a Cauchy problem can be found with the dsolve command if it specifies:

dsolve({sys, ic},{x(t),y(t),…},extra_args),

where sys- system of differential equations, x(t),y(t),... - sequence of uncertain functions; ic - initial or boundary conditions; extra_args is a parameter that defines the method of solving the problem, for example, if the problem is solved numerically, then it is written as type=numeric.

Let's clarify the problem in exercises and perform the following exercises:

The construction of the given system of differential equations is as follows:

> sys:=diff(x(t),t)=-4*x(t)-2*y(t)+2/(exp(t)-1), diff(y(t),t)=6*x(t)+3*y(t)-3/(exp(t)-1);

The general solution of a given system appears on the screen using the following reference:

> dsolve({sys,{x(t),y(t)});

CONCLUSION

The use of computer technologies in the teaching of differential equations increases the efficiency of this lesson, students can make free examples, check it on the computer, and make graphs of geometric figures using the Maple program on the computer, which will create many reliefs for the students.

Thus, after entering a higher education institution, a student will acquire certain skills in using modern information technologies, which will allow students to master the educational material more effectively. The integration of information technologies in education is increasing year by year. In this regard, I believe that the wider use of modern information technologies in classes is appropriate. This improves the quality of lessons and increases the rate of student achievement.

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