

# Use of MathCad software in the preparation of students majoring in engineering.

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**Abstract:** The article discusses the use of the MathCad system in the educational process of students of engineering specialties in the study of disciplines for the development of modern computer technologies and software. Using the MathCad system plays a huge role in solving traditional engineering problems, as well as mathematical programming problems.

**Key words:** software, MathCad, Given, computer technology, programming, differential equations, multimedia.

## I. INTRODUCTION

This article describes the purpose of the following problems, the methodology of solving suggestions and comments and their implementation in practice, its effectiveness. The modern higher education system requires the introduction of innovative technologies, including the widespread use of computer and information technologies in the organization of the educational process. A modern engineer must have extensive knowledge and good training, be able to improve their skills and understand innovations, be able to make non-standard decisions, be able to quickly search and analyze legal and economic information, and know foreign languages and use modern information technology necessary. Such demands require a new approach to ensuring the quality of education of engineers.

Therefore, the article describes the methodology of using the Mathcad system in the process of teaching engineering students modern computer technologies and software. The use of the Mathcad system is of great importance in solving traditional engineering problems as well as mathematical programming problems. For that reason, there is a need to use modern information technologies in the educational process to generalize and improve traditional methods of solving problems in the field of engineering. This problem is reflected in the article.

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## II. RELEVANCE AND NECESSITY OF THE TOPIC

In accordance with the tasks set in the state program for the implementation of the Action Strategy on the five priority areas of development of the Republic of Uzbekistan in the "Year of Science, Enlightenment and Digital Economy" and through the widespread introduction of modern information technologies The Resolution of the President of the Republic of Uzbekistan dated April 28, 2020 No. PP-4699 on the development of digital economy and e-government was adopted. The decision of the state to choose the way of development of the digital economy opens new directions in the field of information technology and electronic document management in general. The decision of the state to choose the way of development of the digital economy opens new directions in the field of information technology and electronic document management in general. The shift towards "digital technology" has been fueled by the development of the global Internet and quality communications. Therefore, the training of engineering students as advanced specialists in the field of modern computer technology is of great importance today.

**Aims and objectives of the topic.** The use of tools designed to solve mathematical problems in engineering descriptions is currently undergoing a fourth revolutionary change, consisting of Mathcad, Mathematica, Matlab, Derive, Theorist, and other powerful computer packages (the first three stages of this revolution were marked by the timely emergence of tools such as a

scoreboard or microcalculator). They allow the student to focus on the material being studied, freeing them from large-scale, outdated, monotonous calculations.

The range of tasks performed using these computer packages is very wide, and their use in many ways helps students to work actively and smoothly, increase the efficiency of the learning process and the quality of education. The peculiarity of these computer packages is that they have the following tools (capabilities) and their implementation is as follows:

1. perform digital calculations;
2. perform symbolic (analytical) calculations and changes;
3. create various graphs;
4. creation of documents using new multimedia tools, including hypertext and hypermedia-links;
5. Integration with other software tools.

These software systems allow not only the use of computers in the teaching of mathematics and computer science, but also the teaching of all subjects included in the curriculum in the training of future engineers.

Many optimized engineering tasks can be solved using the MS Excel spreadsheet processor included in the Microsoft Office suite. Although spreadsheets are primarily designed to solve economic problems, their tools can also be used to solve problems in other areas, such as calculating formulas, building graphs and diagrams. So, learning MS Excel is important for engineering professionals and requires them to have the ability to work with MS Excel. However, MS Excel does not have enough capabilities to complete the many and comprehensive data needed to solve engineering problems.

The Mathcad - Mathematical Computer Aided Design package created by MathSoft (USA) has a high capacity to perform such tasks.

Mathcad is a unique collection of applications of modern numerical methods of computer mathematics. It included experiments, rules, and methods of mathematical calculation accumulated as a result of the development of mathematics over the years.

Mathcad package is a software tool for engineering and computational work, it is designed for professional mathematicians, engineers - technologists. It can be used to solve algebraic and differential equations with variable and invariant parameters, to analyze functions and search for their extremums, to construct tables, graphs, and other similar tasks to analyze the solutions found. Mathcad also has its own programming language for solving complex problems.

Mathcad is simply a tool that allows a student to focus on the concepts and logic of methods, algorithms, and get rid of large, over-computational tasks that are difficult to remember. But this tool cannot be used as a visual aid alone without understanding the physical meaning of the task at hand. Despite the widespread penetration of computer technology into all fields and processes, it is difficult to understand the theoretical foundations of mathematics and methods for solving engineering problems without the usual theorems and algorithms.

The basis of training should be based on a computer package with a clear interface and universal capabilities.

In MathCad, mathematical equations are written on paper as they are written on paper. Results can also be obtained at the same time. The user can easily write comments on the equations and also draw 2- and 3-dimensional graphs. One of the advantages of MathCad is its ability to perform complex calculations. MathCad offers a lot of opportunities in solving the user problem, preparing all the scientific works, formatting them and making them look beautiful. MathCad can understand more than a hundred systems of linear and nonlinear equations with variables and constants, operations on matrices and vectors, algebraic calculations, Laplace, Fourier integrals, arrays, simple differential equations, boundary conditions, special derivative differential equations, polynomials. MathCad allows you to visualize the results of scientific work with graphs. The user will be able to easily depict functions in 2 and 3 dimensional graphics, different color views, planes and space. The MathCad Help window is very easy to use, you can easily search for the information you need from this directory.

Classes are organized in such a way that students perform individual tasks independently (each depending on their level of preparation). Every student with a different level of knowledge is obliged to make accurate calculations. The student then, under the guidance of the teacher, determines the possible limit of the variable based on the result of the variable parameters given in the conditions of the Given logic block, as well as analyzes the extreme properties of the obtained results. Thus, by the end of the lesson, each student will have mastered the material at their own level. Students will be able to conduct research independently when there are study guides with sample problem solutions and detailed assignments, which is especially important for the introduction of distance learning.

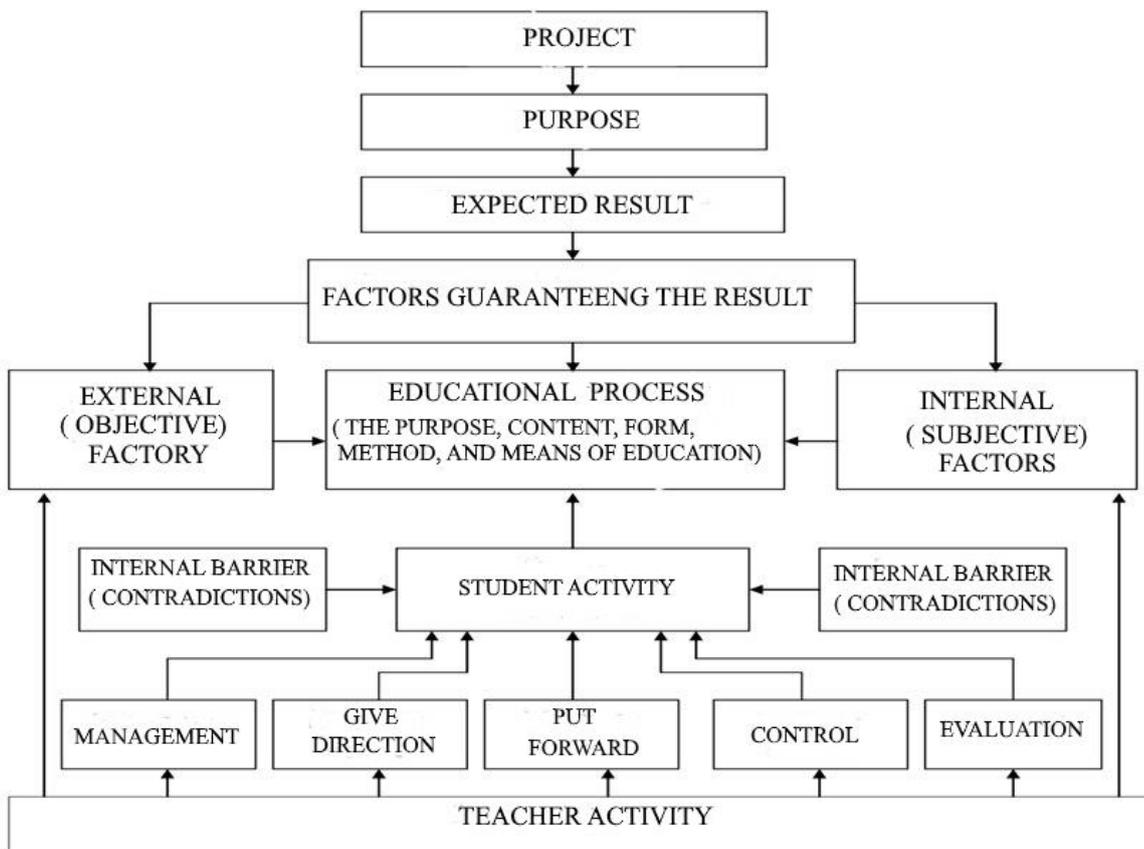
As a result of completing assignments using the MathCad system, students develop the ability to use computer programs to perform engineering tasks. In addition, the use of MathCad in the course work allows students to be fully aware of the achievements of modern computer science and computer technology. This will speed up the process of acquiring new knowledge in order to ensure the high professionalism of future engineers.

Even users with no special knowledge in the field of programming (such as the majority among scientists and engineers) can take full advantage of the achievements of modern computing science and computer technology from the capabilities of MathCad. The user's basic skills are sufficient to work effectively with the MathCad editor, on the other hand, professional programmers can also use a variety of other software tools that significantly expand the capabilities described directly in MathCad itself.

**Scientific and practical significance of the topic.** Today, computer and information technologies are becoming a priority in the development of higher education. Their use helps to plan the time spent on computational work, which requires a lot of work in the learning process, to improve the quality of education, as well as the formation of academic and professional competence of the student.

Practice shows that the use of an integrated Mathcad system in the learning process significantly enriches the learning process, facilitates the comprehension of information, encourages the student to work independently, contributes to their intellectual development.

**Introduction of the topic result.** We have tried to illustrate the functional structure of educational technology through an image as follows. In the presence of social competition, moderate activity, the creation of business immunity to competition, creates an opportunity to "survive" in a conflict of interest, to gain a high position. Therefore, students are getting a conscious approach to learning, acquisition of theoretical and practical knowledge.



**Figure 1:** Functional structure of educational technology

This creates an incentive for them to get an education. Now it is becoming a vital necessity to get an education, to acquire knowledge of a certain profession or specialty, to form certain skills and competencies in this regard. Incentives for learning and its content can be a guarantee of the success of the educational process.

Encouragement to learn is also important in shaping the foundation of learning activities with the participation of students and teachers. In the recent past, the participation of the student in the educational process is satisfied with the role of the subject as a subject who receives theoretical knowledge and demonstrates acquired theoretical knowledge, practical skills, while according to the requirements of educational technology, the student is seen as a leading subject. Now the pupil and the student do not accept the information (knowledge) transmitted by the teacher. Perhaps the instructor's guide acquires theoretical knowledge through independent acquaintance with the recommended teaching resources in accordance with the instruction, developing practical skills and competencies under the teacher's supervision. The student is required to be able to work independently, to develop the ability to put forward ideas, to present arguments, to defend their opinions, to determine the qualities of self-criticism, self-assessment on the basis of theoretical knowledge. The demand of the time requires the student to become an active participant in the educational process, rather than a sluggish listener.

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### **III.SUGGESTIONS AND RECOMMENDATIONS**

In the study of modern computer technology for students majoring in engineering:

- effective organization of independent work in the classroom and outside the classroom at home;
- competencies of independent thinking, creative work skills;
- development of self-control competencies;
- the development of the digital economy and e-government will serve to increase the theoretical and practical significance of research work.

As a result of research and experimental research, a methodology for teaching mathematics based on a competency-based approach has been developed and proven to increase students' knowledge, methodological recommendations and methodological manuals have been developed and put into practice.

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