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MODELING REAL-LIFE PROCESSES THROUGH DIFFERENTIAL EQUATIONS IN MATHEMATICS

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ABSTRACT

One of the important areas of mathematics is differential equations, with the help of which many processes in real life can be accurately described and modeled. These equations are used to express changes in various natural, social and technical processes. Differential equations are mainly important in analyzing variable processes, that is, quantities that change continuously depending on time or other parameters. Many processes in our living environment, such as heat transfer, water level changes, population growth, dynamics and evolution of economic indicators, and even physiological processes occurring in the human body, are studied in depth using differential equations. The role of differential equations in translating many problems and phenomena in real life into mathematical models is invaluable.

Keywords: Differential equations, mathematical modeling, real life processes, physical processes, economic models, biological processes, natural processes, mathematical analysis, engineering problems, dynamic systems.

INTRODUCTION

One of the main advantages of differential equations is that they allow a continuous and logically in-depth analysis of the process. For example, in any situation, these equations are widely used to express the interdependence of some variables and predict their future state. In the process of mathematical modeling, several stages are carried out: first of all, the basic properties of the real process are distinguished, and the connection between them is expressed using mathematical formulas. Then, a differential equation is drawn up, and on this basis it will be possible to approximate or accurately determine how the system will change in future development trends or under certain conditions. In this way, differential equations place real-life problems in a pill called kabilik, with which it becomes possible to interpret a natural or social phenomenon perfectly from a mathematical point of view. Another important aspect is that with the help of differential equations, the possibility of analysis is also opened in various complex systems and in processes involving many parameters. Many changes that occur in life and society cannot be expressed by simple algebraic equations, because in such processes variables such as time, space, movement, and quantity are constantly changing.

MATERIALS AND METHODS

In such situations, with the help of differential equations, the opportunity arises to evaluate dynamic and static processes, ultimately their results in both the short and long term. This approach is very widely used in technology, physics, biology, economics, ecology, demography

and many other fields. That is, this method shows high efficiency not only in theoretical, but also in practical areas. With the Talla approach and properly structured differential equations, it will be possible to model complex systems and observe their variations under the influence of various parameters. Mathematical modeling helps to theoretically Research, predict, systematically analyze and find solutions to all processes occurring in real life. Based on the results of the modeling, it is also possible to identify errors, extreme situations, emergencies and unconventional solutions. This, in turn, serves as the basis for the creation of base, innovative developments, the development of modern knowledge and the development of new technological solutions in practical areas. In the process of applying differential equations in modeling, the focus is on transforming the real life problem into the correct and accurate mathematical expression as possible. It is necessary to identify each variable, take into account derivative dependencies, to refer to all parameters in a complex way. Then all the elements included in the model can act as a whole system, obtaining an accurate result. With the help of differential equations, efficiency increases when modeling continuous or discrete processes, complex and simpler systems, complex local or global changes.[1]

RESULTS AND DISCUSSION

Separately, it should be noted that modeling using differential equations, on the one hand, enriches theoretical knowledge and produces a perfect mathematical picture, and on the other hand, practical results are obtained in solving certain problems by practical application. For example, in the process of production, all movement, flow of resources, energy exchange, process changes, etc.are constantly divided into different stages and are directly related to time and space factors. Differential equations are therefore able to express their relation to some variability, process steps, and stability in any system. Differential equations also allow for pre-analysis through mathematical modeling, correct adoption of management decisions, optimal outcomes, and improved process efficiency. Differential equations are one of the main tools in the correct distribution of time, space, money, energy and other limited resources, in efficient planning, in strategic decision-making. In today's rapidly evolving scientific and technical environment, the use of mathematical modeling, particularly differential equations, is becoming increasingly important in every field.[2]

The real-life applications of differential equations, their power and versatility in representing changing processes in society and nature, are of incomparable importance in the development of modern science and Technology year after year. Each process that takes place in nature or in a technique has a complex structure of many parts, and each of them continues to change for a certain period of time. Organized mathematical modeling helps to effectively manage such complex systems, predict them with accuracy, and independently change what is necessary. While modeling using differential equations in modern mathematics has some limitations, the ability to analyze these constraints in depth and find solutions is also formed in this way. All scientific research, technical innovation, new technologies are carried out precisely on the basis of mathematical analysis and modeling. Therefore, the power and possibility of differential equations is endless, it allows you to deeply understand complex systems and find clear and obvious solutions to emerging situations in real life.[3]

CONCLUSION

In conclusion, the exact modeling of various and complex processes of real life using differential equations is of incomparable importance in both theoretical and practical areas. They allow you to express, analyze, predict the future and effectively manage the various changing processes that occur in nature and society. Mathematical modeling is one of the most necessary and modern tools in the development of modern science and technology, especially in the case carried out through differential equations. Through this process, real-life suitable and reliable solutions are created, scientific and technical progress is accelerated, and fundamental solutions to existing problems are found. Therefore, modeling real-life processes using differential equations is of significant theoretical and practical importance for today's and future lives.

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