On the Economic Application of fractional calculus in Higher Mathematics

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Abstract: With the progress of the times, the level of social productive forces is constantly improving. Therefore, the ideas used in the field of economic management are more advanced, and the economic management system is gradually improving. The idea of higher mathematics has been widely used in the field of economic management, among which the application of calculus is more and more extensive. Therefore, the application of calculus in higher mathematics in the field of economic management can not only improve the economic management system, but also effectively improve the level of economic management. Therefore, it is of great theoretical and practical significance to study the application of calculus in the field of economic management in higher mathematics.

1. Introduction

With the development of the times, the development level of productive forces is constantly improving. The concept and level of economic management are becoming more and more advanced, and the economic management system is becoming more and more perfect. The idea of higher mathematics is more and more widely used in economic management, among which calculus is more and more used in the field of economy. Therefore, the economic application of calculus in higher mathematics is to perfect the economic management system. Therefore, it is of great theoretical and practical significance to study the economic application of calculus in higher mathematics.As an important part of higher mathematics, calculus is a subject derived from function, real number, limit and so on. The study of calculus can promote the rapid solution of calculation, analysis and other problems, which is also an important reason for the wide application of calculus in the field of economic management.

2. Decimal Calculus History

Fractional calculus, also known as arbitrary calculus, has a long history with classical integration. As we all know, in calculus, the 17th century German philosopher and mathematician Leibniz invented the Leibniz symbol. he symbol DX and Dy represent the infinitesimal increments of variable X and Y, respectively. Taking into account the function y=f (x), under the Leibnitz symbol, the n derivative for the x can be recorded as the quotient of the DX and the corresponding derivative of the order can be recorded. Leibniz symbol is widely used in higher mathematics, but it has aroused many doubts in the 17th century. l'hspital French mathematician asked Leibniz in 1695: What if n? Leibniz replied that this would lead to contradictions, but in the future it would eventually lead to beneficial results. in 1819, arbitrary derivatives first appeared in the lacroix manuscript. Assume that the y=XM,M is a positive integer. Lacroix first get the n derivative.

In the past two hundred years, the study of fractional calculus has mainly focused on pure mathematical theory, and the representative mathematicians are Euler, Lagrange, Liuville, Riemann and Holgren. The development of fractional calculus is very slow because it is not supported by physical background in the early stage. in recent decades, it has been found that fractional calculus can well simulate materials and processes with memory and genetic properties. For example, in the field of material viscoelasticity, fractional differential operators are used to describe the constitutive equations of materials. In addition, fractional calculus is also applied to other scientific and

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engineering fields, such as abnormal diffusion, wave propagation, turbulence and other different fields, so fractional calculus is developing rapidly.

Although fractional calculus has a long history and rapid development, few people know fractional calculus in undergraduate education.

3. Summary of Mathematics in Advanced Mathematics

3.1. Differential Thinking

The idea of differential calculus mainly studies the basic law of function change and the law of linear function change under the condition of infinite function, in short, it is to use linear function to express the development law and change of sufficiently small function. A linear function is called a differential function.

3.2. Integrated Thinking

The integral is the inverse effect of the differential, and the idea of the integral is to find the value of the original function in the case of the known function. The integral can be divided into definite integral and infinite integral.

4. The Relationship between Mathematics and Economics in Higher Mathematics

As an important part of the research process with high mathematical function, calculation involves boundary, integral, differential and other fields and their specific applications. The research and learning in this field directly affect production. The in-depth study of mathematics is helpful to optimize the allocation and combination of scarce resources and further promote the development of human economic activities and economic development.

4.1. Broad Areas of Economic Research

Because the economy covers a wide range of fields, it includes not only private social and economic activities, but also must study how enterprises make the most reasonable choices in social and economic life and how to optimize the allocation of scarce resources. The universality of the economy determines that it must be related to other disciplines, and the idea of mathematics can play a connecting and communicating role in the economy. The dissemination of information in the economy helps to make more accurate decisions and assessments.

4.2. Economic Development Opens Up Computational Research

With the rapid development of economy, the support of economic theory plays an increasingly important role in the process of economic development, and economic theory provides the necessary theoretical basis for the development and perfection of mathematics. Economic development; the development of mathematical theory and the continuous improvement of economic level are complementary, because of the mathematical thinking in higher mathematics, modern financial management tends to be tight and logical. The continuous improvement of economic level has further improved the calculation level of higher mathematics, and the overall and overall characteristics of higher mathematics have been more clearly reflected.

5. The Significance of 4-Score Calculus in Advanced Mathematics Teaching

5.1. Increased Interest in Learning

Higher mathematics is the first public basic course for students to contact after entering university, which plays an important role in the study of the whole university for four years. But because concepts and theorems are more abstract and complex than high school mathematics, many students are prone to boring and difficult after contact with advanced mathematics, and lose confidence and interest in learning mathematics. So it is very important to cultivate students' interest in learning. At this time, teachers introduce fractional calculus in the teaching process, and

cultivate students' interest in learning through some simple and easy to understand examples, or the stories of some mathematicians. For example, when the definition of derivative is introduced, the history of fractional calculus is introduced at an appropriate time, and combined with the students' professional particularity, it is emphasized that fractional calculus is the promotion of classical calculus in higher mathematics, which plays an important role in the field of science and engineering. Taking the Caputo fractional derivative of the power function as an example, it shows that when its order $0<\alpha<1$, it can be used as the transition between the zero derivative and the first derivative, and the students can be introduced with an intuitive image. If the fractional derivative is applied to the equation, the anomalous diffusion phenomenon, that is, the phenomenon of non-Brownian motion, can be characterized. The mention of Brownian movement, can also be slightly expanded, causing students to think about the usual phenomena encountered, improve students' interest in learning.

5.2. Expand Students' Mathematical Thinking

Mathematics is a subject of strict logic. And fractional calculus, like integer calculus, has a set of corresponding rigorous theories, but the form is more complex. Through the proper introduction of fractional calculus in the course of higher mathematics teaching, it can cultivate students' interest in mathematics and contribute to the expansion of mathematical thinking. Of course, before teaching, we should fully excavate the knowledge points related to fractional calculus and calculus, create a more smooth atmosphere for students' understanding, and enhance students' confidence in learning. For example, when we introduce the Gamma function, we can further introduce that it is the extension of factorial. This paper introduces the definition of fractional derivative and points out that it is the generalization of integer derivative. Combined with the proper history of calculus development, it shows that fractional derivative is the inevitable result of theoretical development, so as to enhance students' mathematical logic and expand students' mathematical vision.

5.3. Improving Students' Scientific Literacy

Fractional calculus is a booming discipline, which is closely related to other disciplines. In undergraduate education, higher mathematics, as an important basic course of each major in science and engineering, can provide an essential mathematical foundation and mathematical method for the study of students' subsequent courses. Therefore, the proper introduction of fractional calculus in the process of higher mathematics teaching, through the introduction of some concepts and application background of natural popularization, the purposeful cultivation of students' computing ability and self-study ability in each teaching link can enable students to gradually form a global view of knowing trees and trees, and make students' scientific literacy improve effectively. For example, the transformation method of definite integral in higher mathematics is a key content, and teachers can integrate the fractional derivative of power function into teaching when teaching this part. As a result, it not only consolidates the understanding of Gamma function as generalized integral, but also makes the application of commutative element method more flexible, so that students' learning confidence is improved, and the context of each knowledge point is further found, which lays a solid foundation for the flexible application of knowledge.as shown in Figure 1.

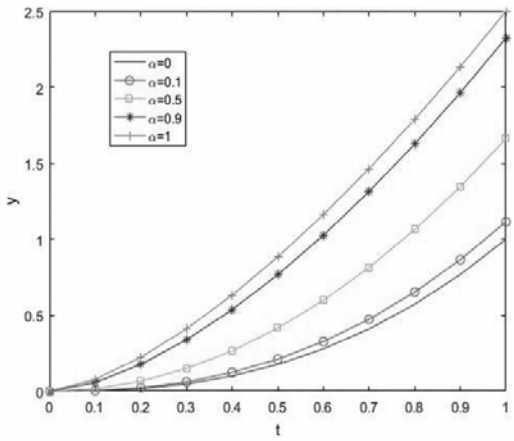

Figure 1 The context of knowledge points

6. The Role of Calculus in Economics in Higher Mathematics

6.1. Specific Application of Differential Thought in Economics

The differential thought that is mainly used in economics is the limit theory in differential thought, which belongs to one of the most widely applied and paid the highest attention in the field of economics. Among them, the highest frequency of application is the limit value and the optimal quantity, and the calculation of these two values is helpful to analyze, judge and estimate the various economic problems in the process of economic management, so as to help enterprises make the optimal decision about the allocation of resources. The limit theory in calculus can not only simulate the range of price fluctuation of a certain commodity in a certain period of time, but then the enterprise can rationalize its marketing decision according to the situation reflected by the simulation results, and realize the maximization of the profit of the enterprise.

6.2. Specific Application of Integral Thought in Economics

The theory of integral thought mainly includes two aspects: definite integral and indefinite integral. Integral is the inverse operation of differential. The main application of the idea of integration is to calculate the original function value through the known function, and the use of the idea of integration can greatly simplify the calculation process of the function, which not only greatly reduces the workload and difficulty of the function calculation, but also effectively improves the speed of solving the function problem. The idea of integral is also widely used to solve the problems of financial interest rate, medical insurance, loan and deposit.

7. Conclusion

As the related theories and ideas of higher mathematics are more and more widely used in the process of economic management, the level of economic management in the future of our country will rise accordingly. The function of calculus thought has also been more and more important in the field of economic management, which greatly affects the level of financial management. It is hoped that in the future, the related research on the application of calculus thought in the economic field of higher mathematics can be perfected and enriched day by day, so that it can play a greater value in economic management. Because the thought of calculus in higher mathematics is also a major focus and difficulty in the learning process of college students, college students should invest more time and energy in learning calculus.

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