

# On the Economic Application of Fractional Differential Integral in Higher Mathematics

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**Abstract:** Mathematics is the subject of studying the change of quantitative digital structure and the concept of space and information. In a sense, mathematics is a kind of criminal science. In the course of human development and social progress, mathematics plays an irreplaceable role. It provides the most basic and powerful support for the development of modern science and technology and information technology and the improvement of people's economic level. Mathematics is a more advanced knowledge of mathematics, the use of economic knowledge of mathematics is very extensive, especially in economic calculation, mathematical knowledge is an essential computing tool, but also one of the important tools for economic analysis. This article will analyze and discuss the application of fractional calculus in economics in higher mathematics.

## 1. Introduction

With the development of society and the continuous improvement of economic level. Instrumentation technology has achieved rapid global development. Especially in the information age of high-speed research and application of science and technology, the application of electronic products and network technology has been very extensive. At present, mathematics has been effectively developed, and the construction and promotion of various industries. Are inseparable from the application of mathematics, from. From the practical point of view, mathematics is not only a subject of knowledge. From its effect. Mathematics has gradually formed a universal implementation and application of technology, the role of mathematics has begun to create value for society. The development of the international field and the research and development of science and technology are more inseparable from the role of mathematical knowledge and have penetrated into all fields of society. As small as a vegetable market price calculation, as large as the Shenzhou VI construction parameters design. The application of calculus in the field of higher mathematics is very broad, and the application of calculus in the field of economy is also very important.

## 2. Fractional Calculus in Higher Mathematics

### 2.1. Calculus Concept in Higher Mathematics

From the academic point of view, calculus is the concept of mathematics in higher mathematics. It mainly refers to the differential integral of the research function in higher mathematics, as well as the branch of mathematics subject of related concepts and practical application. is also the basic subject of mathematics. In terms of content, calculus mainly includes differential calculus and limit, integral and related practical applications, in which differential calculus mainly contains the operation method of finding derivative, which belongs to a set of theoretical knowledge about the rate of change [1]. It can make the function velocity, acceleration and slope of the curve use a set of general symbols for academic discussion, while integral science mainly contains the operation of finding integral, which is the method to define and calculate the area volume and so on. In a broad sense, mathematical analysis includes many branches of calculus, function theory and so on, but at present, mathematical analysis and calculus are usually put into use. Taking mathematical analysis

as the meaning word of equal status of calculus, it is mentioned that the use of mathematical analysis must be associated with calculus.

## 2.2. Concept of Fractional Calculus

Cellular calculus is an important branch of mathematics. Unit birth time to introduce, fractional odd order calculus was born in 1695. Almost in the same era as the classical calculus. The definition of ending calculus in the narrow sense mainly includes fractional differential and fractional integral. This architecture of fractional calculus is very similar to that of calculus, but in fact fractional calculus is a branch of calculus. In general terms, fractional calculus is defined as fractional difference and fractional sum quotient [2]. The application of fractional calculus theory is gradually extended to various fields from the development of economic market in recent years. It is surprising to find in economic calculations that fractional calculus can be used to calculate and express some nonclassical phenomena in natural science and engineering, and therefore fractional calculus has gradually been applied more deeply in the economic market.

## 3. Application of Fractional Calculus in Higher Mathematics in Economy

### 3.1. Marginal Economic Analysis using Fractional Calculus

In the study of marginal quantity in economics, the main core is the application of economic function in absolute quantity and rate of change. The main form of the editorial volume study so far is that when a unit of economic volume changes, it is necessary to analyze how the corresponding one will change. In doing research in the economic field, it can be found that when one variable becomes  $x$  and the other variable becomes  $y$ , the calculated amount obtained from the variation of these variables is usually an average and marginal concept [3]. The average is more that when the variable  $x$  changes in a particular range of circumstances, the actual value of the other variable  $y$  changes, that is, the average rate of change of the  $y$  value can be reflected in the average form within the specified range. while the concept of margin is interpreted as: when the value of the variable  $x$  changes first set the change of  $x$  infinitely close to zero, then the corresponding variable  $y$  value changes the quantity, which will be worth to the marginal value because of the change of the independent variable, and when the independent variable  $x$  changes, the function value  $y$  will also change correspondingly. As shown in figure 1:

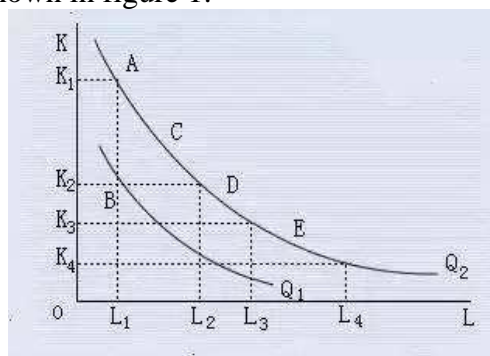


Figure 1 Example of marginal conversion rate

In essence, the concept of margin is a new term cited everywhere in fractional calculus. In the calculation of economic function, the first derivative of independent variable  $x$  is classified as marginal function. To write this marginal function as  $My$ , then consider and solve a problem from an economic point of view, the practical meaning of its marginal function is that when the independent variable changes slightly, the dependent variable changes the relative value of the quantity, and because in economics, its variables  $x$  and  $y$  are given different meanings, there is a big gap in the meaning of the different marginal function, but in the marginal function, the marginal benefit is equal to the marginal cost. As shown in figure 2:

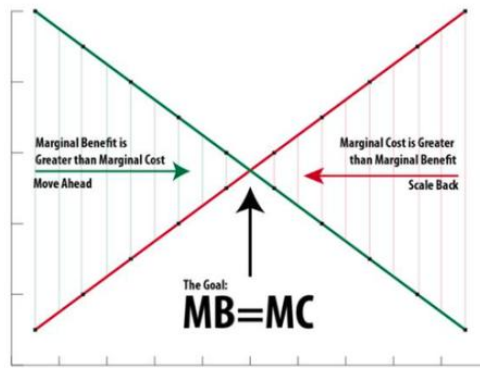


Figure 2 The equality of marginal benefits and marginal costs.

In the process of applying to the actual economic behavior, it can be expressed that the time used by the enterprise to produce the product is 1, and the time cost function of the production product. The marginal cost can be calculated for the first derivative of the function. But the actual marginal cost economy meaning often in the production product time is 1, again produces another product to pay the cost in the economic analysis process. What can be involved is not only the marginal cost, but also the related content such as marginal benefit and marginal economic profit. As shown in figure 3:

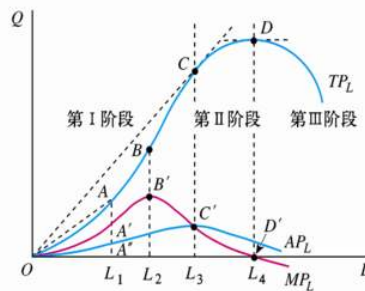


Figure 3 Relationship between marginal yield and marginal gain and marginal profit

Therefore, if we want to control the cost effectively and maximize the profit budget, we can use the mathematical knowledge of fractional calculus to carry on the accurate calculation, then the enterprise can make the accurate forecast of the product profit according to the product output, the higher its output means the enterprise's economic profit is rising.

### 3.2. Using Fractional Calculus for Elastic Analysis of Economics

In the analysis of the editing function, we must consider the economic function as the absolute quantity and the absolute change rate environment. And in real life, in the enterprise to carry on the economic function and the relative change quantity change relation analysis, wants to realize this kind of change relation accurate analysis and the accurate result obtains, its analysis process is called the elasticity analysis. In the economic field, the scope of this analysis is extremely broad. Many economic phenomena can be solved and explained by elastic analysis. Using fractional calculus knowledge for elastic analysis is an effective analytical method [4]. Can the change of independent variables in function response be timely? There is also a big gap in the performance of various types of economic functions in elasticity. Usually, the market demand and the price of market supply have a certain degree of elasticity, and the supply side price of the product also has a certain elasticity. In this economic elastic environment, the elasticity of demand price is usually called demand elasticity. For example, when the demand for a product is more flexible, the range of change in the demand for goods in the market will have a big difference than the range of change in price. Then the change of demand of this commodity is called unit elasticity, and when the change of demand is very similar, the change of demand of commodity is the same as that of commodity price, no matter the increase of price or the decrease of price, the demand of commodity in the market will not change greatly. At this time, the range of changes in commodity demand will be

lower than the range of changes in prices. This will lead to a decline in total revenue. And when the appropriate price adjustment sales will gradually decline, but from the production side, its total revenue will rise. Therefore, from the aspect of elasticity analysis demand, the commodity price in the economic market is more sensitive to the change of demand, and the adjustment of commodity price in the change of market economy will stimulate consumers to buy goods, which will lead to the increase of commodity sales, and then realize the economic profit acquisition and the healthy development of the enterprise. For the economic field, the application of fractional calculus can make the enterprise and market accurately estimate the economic cost input and economic benefit and micro-control, which has very important practical significance and application value.

#### **4. Conclusion**

and the above article content described. The link between economics and higher mathematics can be clearly identified. In today's information age, fractional calculus plays an important role in many economic fields and economic computations. Its application is not only highly centralized but also more precise. Therefore, in the field of economics, we must combine the diversified mathematical knowledge at home and abroad and various mathematical analysis tools to realize the practical application value of mathematics, apply mathematical knowledge to solve the practical problems in the economic operation of life, and more need to master the method of mathematical analysis to help business operators to provide more perfect and scientific economic decision-making.

#### **References**

- [1] Hu Xinghua, Gao Leifu. A study on the evolution law of fractional chaotic economic system based on non-degenerate equilibrium points. *Computer Applied Research*, vol. 34, no. 12, pp. 3668-3671, 2017. DOI:10.3969/j.issn.1001-3695.2017.12.033.
- [2] Dai Zhuxiang. Synchronous control and application of fractional chaotic systems. Jiangsu: Nanjing University of Information Engineering, 2016. DOI:10.7666/d.Y3169704.
- [3] Li Xinhui. fractional q-difference equation boundary value problem and its application. Shandong: Jinan University, 2015. DOI:10.7666/d.Y2914094.
- [4] Zhao Meng. fast algorithm of space-time fractional partial differential equations and their applications. Shandong: Shandong University.