Research on High Precision Algorithm Based on the Transformation of Computer Accounting Financial Management and the Transformation of Fractional Differential Equation

Hongmei Fan*

Henan Vocational College of Applied Technology, Zhengzhou, Henan, China, 450042

*E-mail: 349607324@qq.com

Abstract. With the continuous prosperity and progress of economic globalization, the continuous updating of computer technology makes our society enter the era of information technology. In the context of information technology, the management of information in various industries depends on the use of computer technology. In the process of accounting and financial management, the use of transformation and transformation helps financial managers to lay a good mathematical foundation. This kind of thought can help them to carry on the audit work more easily. In addition, the research on the algorithm of fractional differential equation can obtain high-precision numerical solution with fewer practical nodes. Its use can also improve the efficiency of accounting and financial management.

Keywords: Computer, Accounting and Finance, Differential Equation, High Precision Algorithm

1. Introduction

As we all know, the 21st century is a highly prosperous era of information technology. With the continuous renewal and innovation of information society, the application of computer has penetrated into all fields of our life[1-2]. The transformation of financial management and the application of mathematical thought of transformation improve the simplicity of electronic accounting financial management. It helps accountants better understand the mathematical thinking mode and financial management thinking mode[3].

Fractional differential equation and differential integral equation appeared in the same period of history. In recent years, fractional differential equations have been widely used in natural science and
engineering science. It includes mathematics, engineering and finance. Fractional equation is also widely used in accounting and financial management. The research of high-precision algorithm can help accountants to solve the audit problems more accurately\cite{4-6}.

2. Problems in the financial management of computer accounting

The development of enterprises marks the economic development of the group. With the continuous expansion of the strength of some companies, collectivization has become the symbol of international large companies. The emergence of company integration also makes the financial management of accountants inconvenient. The complicated work of financial department makes the work pressure of accountants more and more.

2.1. The slow update of financial information affects the decision-making of the management

According to the relevant theory of economics, the basic part of enterprise management is information management. The main part of information management is financial information management. In order to get a foothold in the market, enterprises must obtain specific financial information in advance. Only in this way can enterprises control the internal capital flow. However, the update of financial information of many enterprises is very slow nowadays. The opacity of financial information affects the scientific decision-making of enterprises. It will cause unnecessary losses to enterprises.

2.2. Disordered and out of control fund management

To improve the capital utilization rate of an enterprise is the fundamental factor for an enterprise to stop for a long time. However, due to the lack of professional accountants and the imperfection of financial management mechanism, many companies' capital management is chaotic and out of control. This situation will cause waste of funds and increase the burden of enterprises.

2.3. Unclear algorithm of financial management

Financial science is a branch of basic mathematics. Therefore, it is necessary to apply mathematical thinking in the process of financial management. However, many enterprises' accountants have poor mathematical thinking. In addition, their high-precision algorithm of basic mathematics is not clear, which leads to the difficulty of financial management.

3. Fractional differential equation based on transformation and reduction

3.1. Residual function and error equation

First, we can give an example of a fractional differential equation:

$$D^q y(t) = f(t, y(t)) \tag{1}$$

$$y(0) = y_0 \tag{2}$$

We can define the residual equation and error function as follows:

$$\varepsilon(t) = y_0 + \frac{1}{\Gamma(q)} \int_0^t (t - \tau)^{q-1} f(\tau, y^\theta(\tau)) d\tau - y^\theta(t) \tag{3}$$
\[ \delta(t) = y(t) - y^0(t) \tag{4} \]

In these two equations, \( y(t) \) is the initial solution of the equation.

### 3.2. Spectral approximation of residual function

The initial approximate solution of the original differential equation is as follows:

\[ y_{k+1} = y_0 + \sum_j b_{j,k} + 1 f(t_j,y_j) \tag{5} \]

\[ b_{j,k} + 1 = \frac{1}{\Gamma(q+1)} [(t_{k+1} - t_j)^q - (t_{k+1} - t_j+1)^q] \quad j = 0,1,2,\ldots,k \tag{6} \]

Through the use of Lagrange difference polynomials and the transformation of differential matrix, we can find that the spectral approximate equation of residual function is:

\[ \varepsilon(t) = y_0 + \frac{1}{\Gamma(q)} \int_0^t (t - \tau)^q - 1 f(\tau, y^0(\tau)) d\tau - y^0(t) = y_0 + \frac{1}{\Gamma(q)} \int_0^t (t - \tau)^q - 1 \sum_k b_{f,k} L_k(t) d\tau - y^0(t) \tag{7} \]

### 4. Research on high precision solution of fractional differential equation based on spectrum delay correction

Before using the general delay correction method, we can set an approximate vector \( Y^{[0]} = (y_1, y_2, y_3, \ldots, y_n)^T \) and an error vector \( \delta = (\delta_1, \delta_2, \delta_3, \ldots, \delta_n)^T \):

\[ Y^{[1]} = Y^{[0]} + \delta \tag{8} \]

The specific process of general delay correction is as follows:

Step 1: First, we use the fractional order display method to calculate the initial solution:

\[ y^{[0]}_{k+1} \approx y(t_k) \tag{9} \]

Step 2: The approximate value of the residual function is:

\[ \varepsilon_k (k = 1, 2, \ldots, n) \tag{10} \]

Step 3: The approximate value of the error function is:

\[ \delta_k (k = 1, 2, \ldots, n) \tag{11} \]

Step 4: The new approximate solution is:

\[ y^{[1]}_k = y^{[0]}_k + \delta_k (k = 1, 2, \ldots, n) \tag{12} \]

### 5. Numerical example of high precision solution based on fractional differential equation

\[ D^{q_1} y_1(t) = \frac{\Gamma(5 + q_1)}{24} t^4 + t^{8+2q_1} - y_1^2(t) + \left( \frac{q_1}{2} t^\frac{q_1}{2} - t^4 \right)^3 - y_2^2(t) \tag{13} \]
\( D^q y_2(t) = \frac{40320}{r(9 - q_2)} t^{8 - q_1} - 3 \left( \frac{5 + q_2}{2} \right) t \frac{q_2}{2} \frac{9t(1 + q_1)}{4} + \left( \frac{3t^2}{2} - t^4 \right)^3 - y_2(t) + t^{12 + 3q_1} - y_1(t) \) (14)

| n  | Iter | Time     | Error1  | Error2  |
|----|------|----------|---------|---------|
| 1  | 18   | 1.126711 | 1.608308e-6 | 4.064202e-6 |
| 2  | 18   | 1.136405 | 1.154564e-7 | 3.816067e-7 |
| 3  | 17   | 1.204004 | 5.174545e-8 | 1.748159e-7 |
| 4  | 23   | 1.384072 | 2.145454e-8 | 7.602785e-8 |
| 5  | 18   | 1.442811 | 9.052481e-9 | 3.545745e-8 |
| 6  | 17   | 1.500915 | 6.986145e-9 | 2.045157e-8 |

Based on the above analysis, we know that the final result is:

\( y_1(t) = t^{4 + q_1} \) (15)

\( y_2(t) = t^8 - 3t^{4 + \frac{q_2}{2}} + 9t^{4q_1/4} \) (16)

6. Conclusion

Through a large number of experiments and practice, the researchers found that the combination of the idea of transformation and reduction in mathematics and the high-precision solution of fractional order differential equation can effectively improve the mathematical basis of accountants and the efficiency of financial management.

References

[1] Ying-Bo C, Daily Z. Research on the Transformation and Upgrading of Financial Management of Small and Medium-Sized Enterprises—Based on the Perspective of Internet[J]. Management & Technology of SME, 2018.

[2] Hu Y. Research on a three-dimensional reconstruction method based on the feature matching algorithm of a scale-invariant feature transform[J]. Mathematical & Computer Modelling, 2011, 54(3-4):919-923.

[3] Hui C, Lingqi L, Dan X, et al. The Synchrosqueezing Algorithm Based on Generalized S-transform for High-Precision Time-Frequency Analysis[J]. Applied Sciences, 2017, 7(8):769-.

[4] Zhao L, Chen K Q, Zhang Z Z. The Research of High-Precision Interpolation for Complex Trajectory of SCARA Robot Based on NURBS[J]. Applied Mechanics & Materials, 2011,
130-134:147-153.

[5] Xu G, Wei C, Zhu H. Research on the Influence of Government Accounting System Reform on University Financial Management[C] 0.

[6] Z. Cucej. Data source statistics modeling based on measured packet traffic: A case study of protocol algorithm and analytical transformation approach[C] International Conference on Telecommunication in Modern Satellite. IEEE, 2009.