

Application of mathematical modeling software in mathematical modeling

Ting Zheng

Inner Mongolia Medical University

ztyks@163.com

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Abstract: Mathematical modeling is a process of constructing constraints and solving practical problems through mathematical language. Mathematical modeling focuses more on solving practical problems. The setting of the model is subjective and involves a wide range of disciplines. Because of these characteristics, the application of computers in the field of mathematical modeling has its necessity, and computer simulation is the most important application of mathematical modeling. In this paper, the typical application of MATLAB software in mathematical modeling is illustrated to reflect the key role of relevant software in the modeling process.

1. Definition of mathematical modeling and brief introduction of modeling process

Mathematical modeling focuses on solving life problems, combining the actual problems in life with inherent laws, connecting them with mathematical way of thinking and abstract thinking, and integrating data through the application of mathematical formulas and the calculation and analysis of data. The mathematical model needed to solve the problem is formed by mathematical software programming, and then the relevant problems are solved and analyzed by the model, and reasonable results are obtained, which are finally tested. The main steps of modeling are as follows, select the corresponding model, then assume the establishment conditions of the model, also establish the model, as well as use the model to solve questions, at last apply the model to test the conclusion.

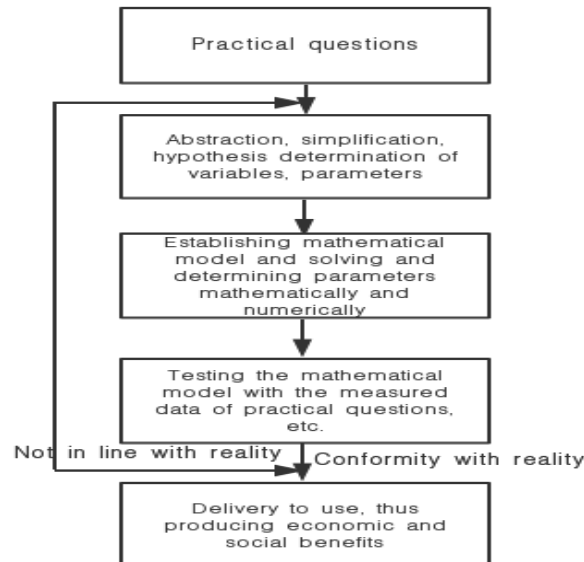


Fig. 1 The flowchart of math model solving question

2. The current mainstream of mathematical software

At present, the popular mathematical software in the direction of science and technology and engineering interface in China mainly includes the following categories: Maple, MATLAB, MathCAD and Mathematica.

2.1. Maple V

This system is a mathematical system software developed by Waterloo University, which not only has the function of precise numerical processing, but also has unique function of symbolic computing. The software also provides a complete set of built-in programming languages internally, allowing users to develop their own applications according to their own needs.

2.2. MATLAB

MATLAB software program mainly includes the main program and a variety of different procedures composed of the toolkit. The software can be used as a pioneer of current mathematical numerical calculation and analysis. It takes the matrix as basic operational data and becomes the preferred tool in linear algebra, mathematical statistics, automatic control, digital signal processing and dynamic system simulation. It is also often used in scientific research and teaching for college students.

2.3. MathCAD

The software is interactive math software from Mathsoft, an American company. This software can be regarded as a very powerful calculator, and it can be used in conjunction with current WPS2013, etc.

2.4. Mathematica

This software is mathematical software developed by Wolfram Research, which has strong numerical analysis and symbolic calculation. But its notation is evaluated not on the basis of Maple, but through its own development. At the same time, the platform is also an interactive platform, where users can transfer and exchange relevant information and data. However, the software is very complicated in the way of data input.

2.5. LINGO

With the refinement of current applications, the classification of software is becoming more and more detailed, among which LINGO is the representative. Its internal features of the relevant language of modeling, can provide users with more than 10 internal functions, its decision variables can be allowed to be integer (i.e., integer programming, including 0-1 integer programming), convenient and flexible, and its execution speed is fast, and good data exchange with Microsoft Excel and other documents.

3. The concrete application of mathematical software in mathematical modeling

In order to study the application of mathematical software in mathematical modeling in detail, this paper will take a certain problem of mathematical contest as an example, and make a comprehensive analysis of the specific application mode of mathematical software. The application process is as follows.

Firstly, the competition was titled three-dimensional reorganization of blood vessels. So let's say that some blood vessels are treated like special tubes, and the center of the sphere rolls around the curved sphere and the surface of the tube. In order to simplify the modeling process, it is assumed that all the pipes in the pipeline have only one intersection point with the axis, and the length of the sphere radius is fixed, and the pixel size and spacing size of the slice image are all 1. The specific method of calculation of the pipe radius and the central axis is obtained, and the plane projection diagram of the central axis is drawn.

Secondly, after a detailed analysis of the problem, it can be found that this is a typical problem of image processing. The amount of information in the problem is relatively large and complex, and it is difficult to complete the modeling task by relying solely on human beings. Therefore, computer technology is needed to analyze the problem. Mathematica software will be used here to conduct the comprehensive analysis of image information. In the specific application process of the software,

BMP graphics "0. Bmp" will be transformed into corresponding matrix by issuing the "Import" command. The overall matrix form is 512*512 large matrix, where white dot corresponds to 1 and black dot corresponds to 0. When issuing ReadBMP conversion command, white dot corresponds to 255 and black dot corresponds to 0. Because the overall amount of data is bigger, as well as the value of the whole data is not the same, of which the most boundary point data value is outstanding, by way of boundary point data filtering, reduce overall data analysis tasks, to boundary point filtering task, and then according to the boundary point data for 3d graphics rendering tasks. At this time, the pipeline image will be presented intuitively. Through further application of the software animation simulation function, the dynamic three-dimensional image of the pipeline can be drawn, and the corresponding solution can be obtained.

Thirdly, relevant personnel need to analyze the question. For the first step, they need to make a string of balls, and use a plane to perform cutting, also obtain a series of circles of cut graphics, as well as the envelope of these circles is the graphic boundary. Of all circles, there is one that has the longest radius. Because the section intersects only one point with the central axis, the plane centered at this focal point intersects the line of the sphere. Because the envelope of the intersecting line of the sphere is the graph of the plane of section, the boundary distance is the longest at the center of the circle, and the boundary distance of all the center of the circle is the largest at the center of the circle. Therefore, when there is only one intersection point between the tangent plane and the central axis, and the radius of the sphere is fixed, the maximum distance from the tangent plane graph to the boundary is the intersection point between the tangent plane and the central axis. The distance between the point and the boundary is the radius of the sphere.

Then, after the corresponding analysis, the calculation of radius and central axis can be expanded. According to the above analysis and the way of finding boundary points at each layer, relevant personnel can calculate the distance between the maximum inner point to the boundary and the boundary, and then complete the calculation tasks of the ball radius, the position of section intersection point and the central axis.

Continually, after obtaining the central axis, the calculators shall use the ListPlot command to complete the drawing of the projective view of the central axis in XY, XZ and YZ planes, and use the "Fit" command to complete the equation optimization of the projection line. In this process, the calculators can reasonably choose the types of fitting curves according to the data point graphs, so as to ensure the degree of fitting curves and data consistency. During the production of the YZ plane projection diagram, high attention should be paid to the graph distribution similar to the arctangent function graph. The "Fit" command should be used to expand equation optimization of the projection through the application of the ArcTan function to obtain the corresponding graph. In the process of making XZ plane projection diagram, ListPlot command can be used to draw the projection diagram of the intersection of central axes, and the equation optimization should be completed through the application of polynomials. Use the ListPlot command to plot the projection diagram of the intersection points of the central axis on the XY plane, and use the circle equation to expand the equation to fit. Because all the curves obtained are consistent with the calculated results, the computational staff can complete combination of parametric equations of the central axis according to specific requirements.

4. The significance of applying mathematical modeling software

Using mathematical modeling software to carry out mathematical experiments and modeling are to consolidate and strengthen mathematical knowledge and application, and meet the needs of cultivating professional and technical talents with high mathematical level, strong innovation ability and rich practical experience. Its development in colleges and universities will be of far-reaching significance to cultivate students' interest in mathematics learning, strengthen their ability to apply mathematics and stimulate their awareness of analyzing and solving practical problems with modern information technology.

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